GULF OIL SPILL INTERAGENCY GROUP

Teleconference Agenda for 1200 January 30, 1991

- Introductions: Chairman, RADM Joel D. Sipes, USCG
- Situation Update
  - CIA
  - USIAT (CAPT Don Jensen, USCG, call from Saudi Arabia)
- Spill Forecast - NOAA
- International Response - DOS
- SITREPS
- Future meetings
- Other

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Report	Coast Guard Report--Persian Gulf Oil Spill (4 pp.)	01/30/91	(b)(1)	S

Collection:

Record Group: Bush Presidential Records
Office: Domestic Policy Council
Series: Schulteiss, Dean
Subseries: Subject File
WHORM Cat.:
File Location: Iraqi Oil Spill [6]

Date Closed:	1/28/2003	**OA/ID Number:**	CF00553-011
FOIA/SYS Case #:	1998-0099-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
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(George Bush Library)

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02. Report	Coast Guard Report--Persian Gulf Oil Spill (3 pp.)	01/29/91	(b)(1)	S

Collection:

Record Group: Bush Presidential Records
Office: Domestic Policy Council
Series: Schulteiss, Dean
Subseries: Subject File
WHORM Cat.:
File Location: Iraqi Oil Spill [6]

Date Closed:	1/28/2003	**OA/ID Number:**	CF00553-011
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THE WHITE HOUSE

WASHINGTON

January 29, 1991

MEMORANDUM FOR MICHAEL JACKSON

FROM: STEPHEN I. DANZANSKY SID

SUBJECT: Gulf Oil Spill: Rules of Engagement

There apparently continues to be some interagency confusion as to the line of authority for both press briefing and public statements (including congressional testimony and point-of-contact) on the Gulf Oil Spill. Individuals and agencies, either out of ignorance or petulance, insist upon being available to the press to give information, advice, statements, expert opinion and conjecture on the environmental problems caused by the oil spill or related ignition scenarios.

We need to continue to reiterate the ground rules as agreed to at the highest levels of the White House, DOD and JCS:

(1) The U.S. is not "in charge" of the cleanup. The Saudi government has assumed control of the situation, and in that context, has asked the help and technical advice of the USG. The President has responded to this request by dispatching the National Response Team to the area, led by the Coast Guard. For purposes of the Exxon-Valdez spill, EPA was the Chair of the response team, for the purposes of the Gulf Mission, the Coast Guard will lead.

(2) The team arrived in Saudi Arabia yesterday with members from EPA, NOAA, the Corps of Engineers and of course the Coast Guard. They reported to the Saudi officials requesting the assistance and set about to provide the assessments and advice requested of the Saudis.

(3) All press inquiries as to the mission, findings, opinions, taskings and future requirements of the NRT should be directed to the Department of Defense or the Saudi Government. It is expected that, as appropriate, the DOD in its daily briefings at the Pentagon or in Riyadh may well report on the activities of the NRT or provide the opportunity for the press to question the team through the Coast Guard as chairman. Other members of the NRT may serve as resources to the Coast Guard when requested, but the principal spokesman will the Coast Guard representative through the Pentagon's regular briefing process.

(4) Any congressional requests for testimony on the Gulf spill or any other environmental situation in the war theatre should be referred to the Pentagon, which will in turn coordinate both testimony and witnesses.

(5) Departments and agencies should not be speaking with the press or Congress, formally or informally, about these issues except through the aforementioned procedure.

SID

NATIONAL SECURITY COUNCIL

28-Jan-1991 10:27 EDT

MEMORANDUM FOR:

FROM:
(WHSR_ROUTER@WHSR)

SUBJECT: 28 JAN 91 MEPA STATEMENT ON IRAQI OIL SPILL

<DIST>
PRT: BOOK
SIT: WHSR_IRAQ DEAL MELBY VAX

<PREC>
IMMEDIATE
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<ORIG>
FM AMEMBASSY RIYADH

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TO RUEHC/SECSTATE WASHDC IMMEDIATE 7074
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INFO RUEHWW/GULF WAR COLLECTIVE
RUEHHH/OPEC COLLECTIVE

<SUBJ>
MEPA STATEMENT ON IRAQI OIL SPILL

<TEXT>
BT
UNCLAS SECTION 01 OF 03 RIYADH 01033
DEPARTMENT FOR EB/ERF AND NEA/ARP
DOE FOR IE FOR EASTON, GRUNDY AND BRODMAN
NSC FOR MELBY
E.O. 12356: N/A
TAGS: EPET, SENV, SA
SUBJECT: MEPA STATEMENT ON IRAQI OIL SPILL
1. THE FOLLOWING ARE EXCERPTS FROM THE PRESS STATEMENT READ JANUARY 27 BY DR. ABDULBAR AL-GAIN, THE DIRECTOR-GENERAL OF THE METEOROLOGICAL AND ENVIRONMENTAL PROTECTION AGENCY (MEPA) AND THE MAN PICKED BY THE SAG TO COORDINATE THE CLEAN-UP OF THE IRAQI OIL FLOOD IN THE

GULF. IN IT, HE ACCUSES SADDAM HUSAYN OF "WAGING WAR ON THE REGION'S WILDLIFE", AND "ENVIRONMENTAL TERRORISM". HE ALSO NOTES THAT "A DELIBERATE AND IRRESPONSIBLE ACT SUCH AS THIS OIL SPILL IS NOT ONLY A CRIME AGAINST THE NORMS OF RESPONSIBLE BEHAVIOR AND INTERNATIONAL LAW, BUT IT RUNS COUNTER TO THE VERY PRINCIPLES OF OUR RELIGION AND SHOULD BE JUDGED IN THAT CONTEXT."

BEGIN TEXT:

LADIES AND GENTLEMEN, IT IS MY UNFORTUNATE DUTY TO PRESENT THE RESULTS OF OUR EFFORTS TO DATE TO RESPOND TO THE MASSIVE OIL SPILL CAUSED BY THE IRAQIS WHEN THEY RELEASED OIL FROM THE AL-AHMADI SEA ISLAND OIL TERMINAL INTO THE SEA.

IN THIS STATEMENT I WILL PROVIDE SOME DETAILS REGARDING THE SPILL ITSELF, OUR EFFORTS TO PROTECT COASTAL FACILITIES, AND SOME OF THE ENVIRONMENTAL IMPACTS OF CONCERN THAT WE ARE ATTEMPTING TO ADDRESS. IN ADDITION, I WILL ALSO PROVIDE SOME BACKGROUND ON THE CONTEXT IN WHICH THE SPILL HAS OCCURRED AND WHY WE, AS AN ISLAMIC GULF NATION, FIND THIS ACT SO ABHORRENT AND SO OUTSIDE THE BOUNDS OF THE ENVIRONMENTAL REGIME THAT WE HAVE ALL WORKED SO HARD TO ESTABLISH

THE PROGRAM THAT WE HAVE INITIATED HAS SEVERAL ASPECTS:

1. PLANS FOR PROTECTION OF IMPORTANT FACILITIES WERE PREPARED WELL IN ADVANCE OF THE SPILL. THESE FACILITIES ARE EITHER NOW PROTECTED OR IN THE PROCESS OF BEING PROTECTED. THERE IS NO RISK TO THE KINGDOM'S DESALINATION OR ELECTRICAL GENERATING CAPABILITY.

2. A SPILL MANAGEMENT OFFICE HAS BEEN ESTABLISHED AND STAFFED ON A 24-HOUR BASIS SINCE THE BEGINNING OF HOSTILITIES. THIS OFFICE COORDINATES ALL AVAILABLE INFORMATION REGARDING THE SPILL AND SURVEYS THE EFFECTS OF THE SPILL AND STATUS OF RESPONSE ACTIVITIES. THE STAFF AT THIS OFFICE HAVE AN OPERATIONAL RESPONSIBILITY AND HAVE NOT BEEN CLEARED TO RELEASE INFORMATION. INFORMATION REGARDING SPILL RESPONSE ACTIVITIES WILL BE RELEASED THROUGH BRIEFINGS SUCH AS THIS.

3. WE ARE COORDINATING THE KINGDOM'S NATIONAL RESPONSE CAPABILITY AND RESOURCES, AND AUGMENTING THAT CAPABILITY WITH EXPERTISE FROM COALITION COUNTRIES THROUGHOUT THE WORLD.

4. NOW THAT INITIAL PROTECTION HAS BEEN DEALT WITH, WE WILL DETERMINE WHAT EFFORTS CAN BE TAKEN TO COMBAT THE EFFECTS OF THE SPILL.

5. AT THE SAME TIME, WE ARE ASSESSING THE ENVIRONMENTAL IMPACT OF THE SPILL AND DETERMINE WHAT ACTIONS CAN BE TAKEN TO REDUCE THAT IMPACT.

AS YOU ARE PERHAPS AWARE BY NOW, THIS DELIBERATE SPILL CREATED BY THE IRAQIS MAY WELL BE THE LARGEST IN HISTORY, SURPASSING THE EXXON VALDEZ AND EVEN THE NOWRUZ OIL SPILL WHICH WAS ALSO CREATED BY IRAQI ACTION DURING THEIR PRIOR GULF WAR. THE MOST RECENT AERIAL SURVEILLANCE INFORMATION AT 1800 YESTERDAY EVENING PLACED THE SOUTHERN END OF THE SPILL OFFSHORE FROM SAFANIYAH. IT WAS

BREAKING INTO TWO TAILS, EACH 50 TO 100 METERS IN WIDTH. OCEANOGRAPHIC CIRCULATION IN THE ARABIAN GULF IS COUNTER CLOCKWISE AND THE PRESENT COURSE OF THE SPILL SHOULD CONTINUE IN A SOUTHERLY DIRECTION. WE ARE WORKING WITH THE KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS OIL SPILL MODELING GROUP TO DEVELOP DETAILED TRAJECTORY PREDICTIONS WHICH SHOULD BEGIN TO BECOME AVAILABLE LATER
BT
#1033
BT
UNCLAS SECTION 02 OF 03 RIYADH 01033
DEPARTMENT FOR EB/ERF AND NEA/ARP
DOE FOR IE FOR EASTON, GRUNDY AND BRODMAN
NSC FOR MELBY
E.O. 12356: N/A
TAGS: EPET, SENV, SA
SUBJECT: MEPA STATEMENT ON IRAQI OIL SPILL
TODAY. SUFFICE IT TO SAY THAT, BECAUSE OF OCEANIC CIRCULATION PATTERNS, THE OIL POSES A POTENTIAL THREAT TO THE COASTAL FACILITIES AND NATURAL RESOURCES OF ALL COUNTRIES SURROUNDING THE ARABIAN GULF.
AT PRESENT, THE THREAT TO SAUDI COASTAL FACILITIES HAS BEEN LARGELY DEALT WITH. HAVING LEARNED FROM THE NOWRUZ EXPERIENCE THAT SADDAM HUSSEIN HAS LITTLE REGARD FOR THE ENVIRONMENT, WE HAD TAKEN PRECAUTIONS AND PROTECTED THE DESALINATION PLANTS AT AL-KHAFJI AND AL-SAFANIYAH AND INITIATED PLANS TO PROTECT THE REMAINING DESALINATION PLANTS AND ELECTRICAL GENERATING FACILITIES. THOSE PLANS ARE NOW LARGELY IMPLEMENTED.
WE ARE ALSO EXPANDING OUR EFFORTS TOWARD COMBATING AND FURTHER PROTECTING COASTAL INSTALLATIONS WITH THE ASSISTANCE AND EXPERIENCE OF EXPERTS SUPPLIED BY MEMBER NATIONS OF THE COALITION. THESE EFFORTS WILL CONTINUE TO EXPAND. OUR GOAL IN THIS WILL BE TO EXPAND THE EFFECTIVENESS OF SPILL RESPONSE BY COMBINING RESOURCES AND COORDINATING A SINGLE LARGE SCALE RESPONSE RATHER THAN FIGHTING THE SPILL WITH PARALLEL SMALLER SCALE PROGRAMS.
THE MILITARY TELLS US THAT THE OIL POSES NO THREAT TO THEIR OPERATIONS SO THAT THE REMAINING DANGER IS PRIMARILY TOWARDS THE NATURAL RESOURCES OF THE REGION. THE REGION IS AN IMPORTANT MIGRATORY PATHWAY FOR BIRDS, RICH IN MARINE LIFE. FOLLOWING THE NOWRUZ SPILL, WE SPENT THREE YEARS STUDYING THE IMPACT UPON ENDANGERED TURTLES AND EVEN MORE THREATENED DUGONGS AND DEVELOPING RECOVERY PLANS. THIS SPILL REPRESENTS A THREAT WHICH WAS OUTSIDE THE SCENARIOS CONSIDERED IN THOSE PLANS, AND WE ARE CONCERNED ABOUT THE ABILITY OF THESE SPECIES TO SURVIVE. MARINE LIFE AND FISHERY RESOURCES HAVE BEEN ENDANGERED. SADDAM HUSSEIN IS WAGING WAR ON THE REGION'S WILDLIFE.
I WOULD LIKE TO POINT OUT THAT THE ARABIAN GULF IS A SENSITIVE AREA ENVIRONMENTALLY. THE RELATIVELY NARROW OPENING AT THE STRAITS OF HORMUZ PREVENT COMPLETE

CIRCULATION AND THE WATERS ARE SUBJECT TO LARGE FLUCTUATIONS IN TEMPERATURE AND SALINITY. AS A RESULT, MANY OF THE SPECIES PRESENT OCCUR AT THE EXTREMES OF THEIR TOLERANCE FOR ENVIRONMENTAL PARAMETERS. FURTHER PHYSIOLOGICAL STRESS COULD LIKELY PUSH THEM BEYOND THOSE TOLERANCES, CAUSING POPULATION CHANGES THAT MAY REQUIRE DECADES BEFORE A NEW EQUILIBRIUM CAN BE ATTAINED. WE ANTICIPATE IMPACTS UPON FISHERY PRODUCTION FOR MANY YEARS TO COME.

DUE TO THE COMPLEX NATURE OF THESE NATURAL SYSTEMS, IT WILL BE DIFFICULT, IF NOT IMPOSSIBLE, TO FULLY ASSESS THE DAMAGE TO PRESENT AND FUTURE RESOURCES CAUSED BY THIS ACT WHICH HAS SO APPROPRIATELY BEEN REFERRED TO AS "ENVIRONMENTAL TERRORISM."

THE FRAGILE NATURE OF THE GULF ENVIRONMENT HAS BEEN RECOGNIZED BY ALL OF THE NATIONS SURROUNDING ITS SHORES (INCLUDING IRAQ) WHO ARE SIGNATORIES TO A SERIES OF PROTOCOLS, WHICH HAVE ESTABLISHED A STRONG REGIONAL ENVIRONMENTAL ORGANIZATION, THE REGIONAL ORGANIZATION FOR THE PROTECTION OF THE MARINE ENVIRONMENT (ROPME). ROPME HAS BEEN MARKEDLY SUCCESSFUL IN FOCUSING THE MANY DIFFERING NATIONAL INTERESTS ON THE CAUSE OF CAREFUL AND SUSTAINABLE USE OF ENVIRONMENTAL RESOURCES.

THIS DELIBERATE SPILL IS AGAINST BOTH THE TERMS AND INTENT OF ALL OF THE ROPME PROTOCOLS, PARTICULARLY THE PROTOCOL CONCERNING MARINE POLLUTION RESULTING FROM EXPLORATION AND EXPLOITATION OF THE CONTINENTAL SHELF WHICH HAS BEEN SIGNED BY ALL THE COUNTRIES SURROUNDING THE GULF, INCLUDING IRAQ.

FINALLY, I WOULD LIKE YOU ALL TO UNDERSTAND THAT ISLAM PROVIDES INSTRUCTION THAT OUR USE OF NATURAL RESOURCES MUST BE DONE IN A SUSTAINABLE FASHION WITHOUT DISRUPTING OR UPSETTING THE INTERESTS OF FUTURE GENERATIONS. WE MUST NOT DAMAGE, ABUSE OR POLLUTE THE NATURAL ENVIRONMENT

BT

#1033

BT

UNCLAS SECTION 03 OF 03 RIYADH 01033

DEPARTMENT FOR EB/ERF AND NEA/ARP

DOE FOR IE FOR EASTON, GRUNDY AND BRODMAN

NSC FOR MELBY

E.O. 12356: N/A

TAGS: EPET, SENV, SA

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END TEXT

FREEMAN

BT

#1033

269-2101

NRT

National Response Team (OS-120)
U.S. EPA
Washington, DC
20460

Chair:
Environmental Protection Agency

Vice-Chair:
U.S. Coast Guard

Department of Commerce

Department of the Interior

Department of Agriculture

Department of Defense

Department of State

Department of Justice

Department of Transportation

Department of Health and Human Services

Federal Emergency Management Agency

Department of Energy

Department of Labor

Nuclear Regulatory Commission

JAN 2 2 1991

MEMORANDUM

SUBJECT: Report on Environmental and Human Implications of a Massive Oil Spill in the Persian Gulf

FROM: Jim Makris, Chair

Captain W. F. Holt, USCG, Vice Chair

TO: National Response Team Members

At the request of the NRT during the meeting held on Friday, January 18, the attached report has been prepared by the National Oceanic and Atmospheric Administration (NOAA). It has been reviewed by the Department of Energy, EPA, Department of the Interior, and U.S. Coast Guard. It has also had technical review by several outside institutions.

We ask that you make this report available immediately to the head of your agency, your Public Information Office, your Congressional Liaison Office, and appropriate program offices. The report has been provided to Chief of Staff Sununu.

I really think it is important that you get this to the Head of your Department because of the White House interest and the timeliness of it.

Jim Makris

Report Oil and Chemical Spills Toll-Free 1-800-424-8802

UNCLASSIFIED

(CLASSIFICATION)

CIRCLE ONE BELOW:

IMMEDIATE

PRIORITY

ROUTINE

MODE:

SECURE FAX # _____

ADMIN FAX # 160

PAGES 2

DTG 281510Z JAN 90

RELEASER _____

FROM / LOCATION: GULF OIL SPILL INTERAGENCY GROUP

ACTION / LOCATION:	TIME OF RECEIPT
1. STEVE DAWZANSKY 6630	281513Z
2.	(AR)
3.	
4.	
5.	
6.	

INFORMATION / LOCATION:	
1.	
2.	

REMARKS: _____

WHITE HOUSE SITUATION ROOM 90 JAN 28 A10:25

UNCLASSIFIED

(CLASSIFICATION)

GS-8

Agency	POC	Phone	FAX
To: White House Situation Room	Steve Danzansky	202-395-6313 202-456-2800? 6350	202-395-5221 202-456-2223? 202-395-1206(s)
DOT	TBD		
DOE	John Easton	202-586-4004/8100	202-586-0420
DOE (Saudi)	Ed Smida	9-011-891-3200-262/293/294/300 9-011-891-3200-254 (home) 9-011-891-3296 (FAX) 9-011-891-6316 (FAX)(s)	
Dept of State	Bob Blumberg Tuckerstelly	202-647-6614/1554	202-647-6610
DOD Crisis Coord Center	Joe Muckerman	703-769-9333	703-697-1920 703-697-1915(s)
JCS Crisis Action Center	BGen John Jumper	703-695-2806	703-697-4801 703-693-5487
USACoE	Gary Campbell	703-475-5675 202-272-1001(24hrs)	
USCG	Capt Biff Holt	202-267-0518	202-267-4085
USCG	CDR Doug Lentsch	202-267-0440	202-267-4085
NOAA	John Robinson	202-267-0518 pager 1-800-SKYPAGE	202-267-4085 #113836
NOAA	Jean Snider	202-267-0518	202-267-4085
USCG Crisis Action Center		703-267-2101	202-267-2181 202-267-2107(s)
CIA		703-506-1218	703-790-5736 703-506-1219(s) 703-760-9629(s)
EPA Emerg. Ops Cntr	Jim Makris	202-457-8600	202-252-0154
USCG Public Affairs		202-267-0930/31/32	

Gulf Oil Spill Interagency Group

Teleconference Agenda for 1200, January 28, 1991

- o Situation Update
  - Spill Forecast
  - U.S. Interagency Assist Team (USIAT)
- o Verify Points of Contact (list attached)
- o NOAA Whitepaper (Q's & A's)
  - Clearance
  - How used?
- o U.S. Coast Guard Whitepaper (Q's & A's)
- o Public Affairs
  - DOD/USCG responsibilities
  - Joint Information Group
    Spokesperson(s), routine and high-vis
  - Pinpointing of cause, needed? Who speaks?
- o Spill Forecasts
  -Single POC (NOAA)
- o Daily Sitreps
  - Audience
  - Releasability
- o USIAT augmentation
  - Timing
  - Participation
    Photointerpretation
    Wildlife Rehabilitation
    Coast Guard sensor aircraft assessment

Withdrawal/Redaction Sheet
(George Bush Library)

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03. Diagram	[Oil Spill Diagram] (1 pp.)	01/25/91	(b)(1)	S

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Environmental Implications of a Massive Oil Spill and Fire in the Persian Gulf

Submitted to the National Response Team by the
National Oceanic and Atmospheric Administration

January 23, 1991

Background

At the request of the National Response Team, NOAA examined the environmental implications of a massive oil spill and fire resulting from the demolition of oil field wellheads in Kuwait and simultaneous ignition of other non-reservoir sources such as oil storage tank farms, man-made oil-filled trenches, pipelines and oil tankers. This analysis is qualitative in nature, however is based on Department of Energy assumptions as to the possible extent of destruction. The following agencies have been involved in reviewing this document: Department of Defense, Department of Energy, Department of Interior, Environmental Protection Agency, and the U. S. Coast Guard.

1. What would be the characteristics of the plume of smoke from fires in multiple oil wells, tank farms, and from a massive oil spill?

There will obviously be a pall of dense smoke, blocking the sunlight and rising into the atmosphere and extending far downwind. The combustion by-products of burning crude oil are similar in nature to what is found in the exhaust of a poorly functioning truck or automobile. The principal constituents of the plume would be smoke particles, carbon dioxide, and water vapor, all mixed with background air and other gaseous chemicals (mainly unburned hydrocarbons and small quantities of partially oxidized combustion products such as carbon monoxide - the quantities will vary with the size and intensity of the fire). The plume would also contain sulfur dioxide and various forms of nitrogen oxides, which would interact to produce other gaseous compounds.

If the fire is large and/or intense, the supply of air may not be sufficient to permit all the fuel to be completely burned; combustion under this condition would not be complete, and carbon monoxide concentrations would climb. The dangers of exposure to carbon monoxide are well

known. In essence, the larger the fire, the more care should be taken with respect to carbon monoxide poisoning near the source.

If combustion were incomplete, smoke would be denser and smoke particles might carry incompletely combusted hydrocarbons and other constituents that might constitute a health hazard. The health hazards and the characteristics of the smoke vary with the characteristics of the oil, the size of the spill, and to some extent with the prevailing meteorological conditions. In strong winds, there is usually a ready supply of oxygen to support combustion. In light winds, the heat generated causes convection and replacement air is drawn in at all sides, but sometimes not sufficiently rapidly to ensure efficient delivery of oxygen to all parts of the fire. In both cases, it is the surface area of the fire that determines whether there is sufficient oxygen available to ensure more complete combustion.

Considerable relevant information has been generated in studies of oil refinery and storage facility fires. Laboratory and small-scale burning studies over the last 15 years have attempted to characterize combustion by-products under a variety of conditions, however very little information specific to Arabian crude oils has been reported. Most knowledge of the effects of large fires comes from investigations of large forest fires. In practice, the concentration of smoke particles is likely to be the dominant source of health concern, especially for civilian populations.

Ash fallout from the plume might well be cause for concern in the immediate vicinity of the fire. The governing consideration is that the largest particles would fall out first. These could carry unburnt hydrocarbons and other combustion products with them, and some of these compounds could be hazardous to human health as well as to animals living in the area of deposition. The magnitude of this problem would be controlled by factors that cannot be predicted, such as the size and duration of the fire, the completeness of the combustion, and weather conditions at the time. However, serious depositional hazards would no doubt be limited to the immediate region, up to a hundred miles or so from the source.

2. How large an area would be affected by the smoke plume?

Depending on how much oil is burned, the plume should rise initially up to 3000 to 5000 feet. Within the first few miles, the smoke plume would be dense and black. At tens of miles, the plume would be strongly visible. At hundreds of miles, the plume would be diffuse but visible. At thousands of miles it would be barely detectable.

Smoke particles and other combustion by-products from a massive oil fire would enter the mixed layer of the atmosphere (between ground level and 3,000 to 5,000 feet altitude, over arid areas). There is a natural lid on the spread of these constituents to higher altitudes; the height range of 3,000 to 5,000 feet is a rough average that would be modified by both meteorology and geography. Particles in the mixed layer would generally stay there for a few days (perhaps as long as a week, and depending on whether or not it rains) before depositing to the ground, and hence the areas affected would not be very large.

In the daytime, heating by the sun would cause the plume to be mixed fairly rapidly -- the rising plume would drop back to ground level within a few miles. At night, there might well be clear space underneath the plume; immediately downwind areas would not be greatly influenced. Under these conditions, the highest surface concentrations would be observed in the early morning, when the elevated plume is first mixed to the ground.

If the fire were large and energetic enough, or during stormy periods, the plume could rise through the mixed layer into the "free troposphere" (between 5,000 and about 30,000 feet altitude). The plume would then meander for a period of weeks, becoming striated but retaining its visible identity for perhaps a thousand miles or more. At such long ranges, however, the plume would be widely spread and quite diluted.

It does not appear possible for a fire of this kind to generate enough energy to inject particles into the stratosphere (above 30,000 feet) unless aided by severe storms. Storms of sufficient intensity to cause this effect occur near the equator, but not at Middle Eastern latitudes. Other than by intense equatorial storms, stratospheric injection of surface material occurs only with the most vigorous volcanic eruptions (such as those of Mt. Agung, el Chichon, Mt. Redoubt, etc.) and with such events as atmospheric tests of nuclear weapons. Even nuclear explosions are not always energetic enough to penetrate into the stratosphere.

In conclusion, it would be likely that the plume would be confined to the mixed layer and the free troposphere. The plume might be detectable for a thousand miles or more depending on the size and intensity of the fire. Effects on sunsets and sunrises might be evident for several thousand miles. Over the intervening distance, the plume would slowly disperse into the surrounding air, large particles would soon fall out and the plume's visible identity would slowly be lost. The residence time of particles in the free troposphere is such that long-term accumulations beyond one or two weeks

would not be expected. Any problems that might result would tend to be more local and regional in their extent.

3. Would the smoke and particles lead to global warming or produce a "nuclear winter?"

The oil fires would be too small to cause any significant global warming or widespread cooling, such as could be produced in the "nuclear winter" scenario. In general, particles in the air can lead to a cooling of the atmosphere near the surface.

The nuclear winter scenario is based on the injection of particles into the atmosphere from hundreds of wide-spread nuclear explosions and the firestorms they would cause. This scenario requires the stratospheric injection (and consequent long residence time) of particles, and even a massive oil fire would not produce enough energy to achieve this effect. Second, the fire would be limited to areas downwind of the Persian Gulf region, whereas the nuclear winter scenario requires a global blanket of particles formed by many such plumes originating across several continents.

4. Would the release of carbon dioxide affect global warming?

Any release of carbon dioxide would have some influence on the warming of the atmosphere, but the amount released by a massive oil fires would be negligible in comparison to what is normally released as a result of burning of coal and other fuels, forest fires, agricultural fires, etc. Even if an oil field which produced a significant fraction, say 10%, of the world's consumption of petroleum were set afire, it would contribute no more than a few percent to the rate at which carbon dioxide is normally produced, and unlikely to significantly increase or accelerate global warming.

5. Would crop productivity be influenced?

Ash and smoke particles will deposit on crops within a few miles of the fires causing a temporary and minor reduction in photosynthesis. Blocking and scattering of sunlight would also have a minor and temporary effect within the first few miles.

Particles in the plume would clearly affect solar radiation arriving at the surface. Near the origin, large particles would create a regime of extended partial shade. All wavelengths of light would be affected, including those that drive photosynthesis. However, large particles tend to deposit relatively quickly as the plume wanders across the landscape. If the plume always followed the same path, then we would expect there to be a swath of reduced crop productivity beneath the plume. But in practice the plume would meander with the wind and so the effect would be distributed and diluted across a broad region rather than focussed on some specific locale.

The average size of particles in the plume would decrease with increasing distance from the origin. Not only do the larger particles drop out first, but new small particles would be generated by chemical reactions occurring in the plume. After the large particles had mostly dropped out, the remaining small particles would act more as scatterers of light than as blockers. Even though the direct solar beam may be somewhat reduced, experiments have shown that most of the reduction is made up by increased scattered light arriving at the surface. Thus, the total radiation available for photosynthesis would not remain as low as would be expected if the direct solar beam only were considered. The overall consequence is that effects on solar radiation and hence on crop productivity would be largest near the fire, and would diminish rapidly with distance from it. If crops are significantly affected, subsistence farming, herding, and grazing could also be impacted.

6. Would there be effects from other constituents in the smoke?

The oil contains about 2.5% sulfur, which will produce significant concentrations of sulfur dioxide if burned in large quantities. In addition, there would be concentrations of nitrogen oxides that, together with the sulfur dioxide, would cause any rain generated from the same air mass as the plume to be acidified more than normal. There could then be localized deposition comparable to, or perhaps somewhat in excess of that observed downwind of industrialized areas (e.g. in Europe or eastern North America). Another potential effect from the release of nitrogen oxides and unburned hydrocarbons could be the formation of tropospheric smog. This effect would be greatest in summer when ultraviolet light and temperatures are highest.

7. How would a massive oil spill, originating along the coast of Kuwait, move and spread through the Persian Gulf?

Winds in the northern Persian Gulf during the first few months of the year are predominantly from the northwest at average velocities of ten miles per hour. The general circulation along the Kuwait and Saudi Arabian coasts is to the south-southeast with a slight tendency for currents to accelerate along the southern coast. Typical current velocities vary from a few tenths of a knot in the north to just less than a knot in the south. A massive spill originating along the coast of Kuwait would move south along the coast, spreading in a widening band. Shoreline oiling would begin almost immediately in Kuwait and the leading edge of the spill would reach Saudi Arabian coastal waters within a few days to two weeks depending on weather and initial source location. A major spill would be transported along the Kuwait/Saudi Arabian coast for hundreds of miles.

Currents within Kuwait Harbor are dominated by tides, reaching a velocity of about one knot at the entrance with weaker currents further back into the harbor. The net effect of harbor currents would be an oscillatory movement in the floating oil that would slowly flush out of the harbor region over a period of several weeks to a month. Prior to this time, local winds would tend to strand a large fraction of the oil along the Kuwait shoreline. Because of variability in the winds, it is likely that all of the harbor shoreline would be impacted, but with more persistent winds from the northwest, oil would tend to concentrate on the southern edge of the harbor along the Kuwait City waterfront. The northern and western sections of Kuwait Harbor have extensive tidal flats which would probably provide areas where large tar mats (collections of submerged oil and sand) would tend to form under conditions of heavy oiling.

Along the east coast of Kuwait and Saudi Arabia the currents flow generally to the south-southwest parallel to the shore. Oil spilled into Kuwait waters is likely to drift down the coast under the influence of this current system and the prevailing winds. The advance of the oil would depend on weather conditions, however oil would typically move between 5 and 15 miles a day along the coast of Kuwait, speeding up slightly as it moved south along the eastern coast of Saudi Arabia. As the oil moved south, variable winds would tend to distribute it into a coastal swath that widened as it moved. For a large spill, coastal impacts would be expected along a large fraction of the shoreline with particularly heavy deposits associated with headlands (Ra's al Quilay'ah, Ra's al Zawr, Ra's al Khafji, and so on down the coast). Oil would tend to accumulate in coastal embayments (north of Jabail, south of Ra's al Ghar, etc.).

In the vicinity of Ras Tanura the flow separates from the shoreline and moves east past Bahrain and Qatar. Under the combined influence of the winds and currents, oil in this area would tend to move toward the southeast and impact the shorelines of northern Bahrain and Qatar. "Cross Gulf" currents in this area have significant mixing effect and previous spills occurring north of Bahrain have resulted in some oil drifting over to the Iranian coastline when westerly winds were present. Gulf waters around and south of Bahrain have sluggish circulation that would tend to accumulate floating oil for longer periods. It should be noted however, that previous spills have not entered the area south of Bahrain, and in the absence of sustained strong winds from the north, impacts in this area are not likely.

8. How might desalinization plants in the area be affected?

Much of the drinking water in the region is provided by desalinated water. Kuwait, for example, gets over three-fourths of its water supply from this source. A large percentage of the drinking water for Riyadh comes from desalination plants on the Gulf. The same plants also supply the majority of the power needs for the region. In Kuwait during the Nowruz spill, it was estimated that an extended summer interruption of power for air conditioning would lead to a large number of fatalities.

Relatively small amounts of oil can affect desalinization plant operations. During the Nowruz oil spill, the Aziziyah desalinization plant in Saudi Arabia was temporarily closed as a precautionary measure because of oil-fouled sediments near its intake. Due to shallow water, the desalinization intakes in many cases are close to the surface.

In the case of a large spill near Kuwait, the three major desalinization plants, Doha, Al Shuwaik, and Al Shuaiba, would be at risk. The first two are in Kuwait harbor and would be at risk from a localized spill in the area. Al Shuaiba is on the southern Kuwait coast and is more exposed, as is the small Saudi plant at Khafji, although the large spill at Nowruz did not reach them.

By the time the spill were to reach the larger Saudi plants at Jubail and Khobar, or the ones in Bahrain and Qatar, it would have weathered substantially with most of its water soluble components removed. The plants in this region have contingency plans to provide protection of the

intakes from floating oil, and in the case of the plant in Jubail, Abu Ali Island offers a natural barrier to slicks from the north.

9. What natural processes would affect the spill?

Arabian crude oil varies slightly from field to field, but once released into the environment a number of processes would begin to change the oil's characteristics dramatically. The most important of these processes would be evaporation, formation of a water-in-oil emulsion, and sand fall. A much smaller fraction of the oil would dissolve into the water column. In combination, these processes would result in about half of the oil being removed from the water surface over a period of a two to ten days. During this period, the density of oil on the surface would increase from an initial value of 0.87 to about 0.96 g/cm^3.

Larger slicks would tend to disaggregate into small floating patches of oil and tar balls. Along beaches, these patches of oil could accumulate, and in areas of heavier accumulations, the patches would run together, mix with sand, and form tar mats similar in consistency to softened asphalt pavement.

Strong winds in the northern Gulf create sand storms that result in very large sand deposition over coastal waters. These tend to be at an extreme during the "shamal" period in spring, but high suspended particulate concentrations are common throughout the year with typical air quality standards exceeded for a significant fraction of the time. These large sand depositions would settle out on a surface oil slick, increasing the density of the oil such that it would sink. Oil reaching the bottom in this manner would do so in a widely scattered form and, unlike the coastal accumulations, not aggregate into tar mats. During the Nowruz spill, large surface slicks did not appear to exist on the surface beyond about six weeks, being removed by evaporation or sunk by sand deposition. Widely scattered tar balls did continue to float for longer periods and occasionally come ashore in isolated patches.

10. How toxic is Arabian crude oil and how does its toxicity vary over time?

Acute toxicity to marine organisms is primarily a function of the percentage of low molecular weight compounds in the oil. For most Arabian crudes, this fraction generally represents 20-25% by weight of the

total oil. These compounds have a solubility in water, under ideal conditions, of about 22 parts per million (ppm).

This level of dissolved hydrocarbons could be acutely toxic to many marine organisms if it persisted in a localized area for a long enough period of time. In laboratory tests, marine organisms suffered a 50% mortality when exposed to concentrations of between 1.1 and 17 ppm over a 96 hour period.

Dissolved hydrocarbons are, however, generally concentrated near the water's surface and persist only until evaporative processes remove the low molecular weight compounds. The rate of this loss is dependant on many factors but is generally rapid. In most spills, elevated hydrocarbon levels are confined to the top meter of the water and usually do not persist beyond several hours.

11. How sensitive are the biological resources of the Persian Gulf to oil spills?

Although several ecological habitats and fisheries resources are at risk, the effects of a major oil spill in this region are not likely to be profound because these resources have survived and apparently rebounded from a long period of oil spills.

Habitats at risk include coral reefs and sea grass beds; important resources include the dugong (a large marine mammal), sea turtles and shrimp. Critical habitats in the region include sections of the coastline of Iran and United Arab Emirates. However, both of these regions are far enough removed from the coast of Kuwait that the oil reaching these areas would be substantially weathered and much reduced in toxicity. Therefore, concern should be focused on important resources of the Northwestern Gulf.

Coral reefs will likely survive a large oil spill unless use of dispersants becomes intensive and prolonged. There are small platform coral reefs between Abu Ali and and Safaniyah off the Saudi Arabian coastline and reefs north of Bahrain and Qatar. In 1980, a spill from a broken pipeline off Ras Tanura impacted the coast of Bahrain. No long term impacts on the coral reefs could be detected. Recent mesocosm studies concluded that healthy reef corals can tolerate relatively short (1 - 5 day) exposure to both fresh floating and dispersed Arabian crude oil with no observable long term (1 year) effects on growth and colonization. Some coral mortality is likely to result if dispersants were used to control the slick over a long

period. Effects of dispersant use would be less during the warm season and most severe during winter months when a natural cycle of bleaching occurs.

Patchy distributions of sea grass beds and mangroves occur all along the Saudi Arabian coastline, in the channels between Saudi Arabia and Bahrain, and between Bahrain and Qatar. These grassbeds provide important habitats for several species including the commercially harvested penaeid shrimp. Young green turtles feed on these seagrasses. While seagrasses could suffer from an impact of fresh crude oil, they have generally quickly recovered after past spills. In 1970, a 100,000 barrel oil spill occurred in Tarut Bay, an area of around 400 sq. km. Tarut Bay contains mud flats, grassbeds, black mangroves and shrimp spawning areas. The spill extended from shore to shore and left large tarmats on the beaches. Even ten years later, surveys of oil on the beach showed that this area was more contaminated than the average Saudi shoreline. There are, however, still living mangroves and an active local fishing industry in this area.

The Dugong, a large manatee-like marine mammal, lives and feeds along the Gulf coast. It ranges all along the Indian Ocean shoreline. Dugong mate in February and March, in shallow water, with a gestation period of 1 year. They have naked bodies, which implies metabolic heat is controlled by blubber. Thus they may be more like pinnipeds than otters. A more serious threat may be physical damage to unseen animals due to boat operations. During the massive and chronic Nowruz spill in 1983, there was some impact on them, but recent observations have shown a stronger than expected population with 900 animals recorded in one sighting in the Bahrain region.

There may be some risk of damage to recently hatched turtle populations if there is heavy oiling of shorelines during spring on several islands offshore of Saudi Arabia but the risk of significant damage to adults is low. The green turtle occurs in the Gulf throughout the year, feeding in seagrass beds. Green turtles are common in Tarut Bay, and often caught in shrimp trawls. The populations mainly breed on Karan, Jana, Kurayan, and Jurayd Islands, less so on other islands. Karan Island is the breeding area for 80% of the Gulf green turtle population. Mainland breeding success is low. Adult and half-grown green turtles are common in local seagrass pastures, between Safaniya and al'Uqayr, but most green turtles migrate far beyond this coastline. They are very common and harvested in the Southern Gulf to the west coast of Pakistan and India, but may not breed there now. Thus, the breeding populations of the western Gulf may be the source of animals as far east as India.

Juveniles can experience high mortality when they migrate across oiled beaches during their release cycle. During the Norwuz spill, there was some turtle mortality on the islands, but, fortunately, this was small because they tended to make their nesting sites on the southern half of the islands and are therefore somewhat sheltered from oil coming from the north.

Oiling studies indicate that oil irritates the turtle's mucus membranes, a condition which can result in lesions. Since they are vegetarians, they are less likely to biomagnify hydrocarbons or their metabolites.

The Hawksbill turtle is also a Gulf resident and may be an endangered species. It also uses island breeding sites. It is common, but less abundant than the green turtle. It is also smaller and carnivorous, feeding on pelagic animals. It makes shallower nests than the green turtle, and nests mainly April-July.

There are a few species of seabirds that occur only in this area, some of which breed in the winter season, and others that migrate through or feed in the area. There have been incidents of large numbers of oiled seabirds during past spills in the region. Birds have been impacted both by direct oiling and by oil contamination of their food supply. Although information on bird populations in the area is not good, there have been other significant impacts on some species by the local practice of egg collection for food. A massive oil spill could result in significant impacts to local populations of wide-ranging species. Species that reside only in this area may have their total populations severely reduced. The coastline serves as a migratory route for other species which may be impacted by oiling of the coastline.

There have been apparently minor impacts to fisheries of past spills. Shrimp are targets of one of the most important fisheries in the northwestern Gulf. Shrimp grounds occur off northern Saudi Arabia, and are subject to harvest by foreign industrial trawlers. After reaching peak landings in 1967-68 (17,000 tons), landings declined into the mid-1980's (9,000 tons). Regional authorities recommended seasonal closure from February through June but such closures may not have been implemented. Recruitment of shrimp increased in 1982-83, but other information suggests overall recruitment has been declining in the 1980's due to environmental degradation, land reclamation in former nursery areas and reduced rate of flow of Shatt Al-Arab waterway. Juvenile shrimp, which presumably occur in eelgrass and inshore in heavily vegetated areas, are

considerably more susceptible to oil toxicity than adults; stocks may be severely damaged by chronic oiling in these environments.

In 1980, a 100,000 barrel oil spill from a broken pipeline off Ras Tanura impacted the coast of Bahrain. No long term impacts on the shrimp harvest could be detected. During the Nowruz spill in 1983, fishing vessels in the region had nets and catch contaminated by oil, but no significant hydrocarbon residues were detected in the fish population.

Kuwait itself has been spared major oil spills except for a 130,000 barrel spill that occurred at Mina Al-Ahmahdi South Pier in 1982. Dispersants were used and subsequent analysis showed increased hydrocarbon concentration in oysters. Shellfish, however, are not a common staple in the local diet.

12. What would be the long-term fate of a massive oil spill in this region?

The marine environmental effects of a major spill in this region are not likely to be long term or irreversible. The long term effects of the Nowruz oil spill during the Iran-Iraq war, one of the largest oil spills in history, appear to have been minimal. The area has been subject to more or less continuous small spills so that background oil pollution levels are high. A 1983 estimate of yearly oil spillage through normal operations was larger than the total amount spilled in the EXXON VALDEZ accident. Because the water is so shallow, the Gulf is flushed quite rapidly for a body of water of its surface area. The estimated flushing time through the Straits of Hormuz is between two and six years. Therefore, the residence time for any pollutant is much shorter than other comparable water bodies such as, for example, the Red Sea.

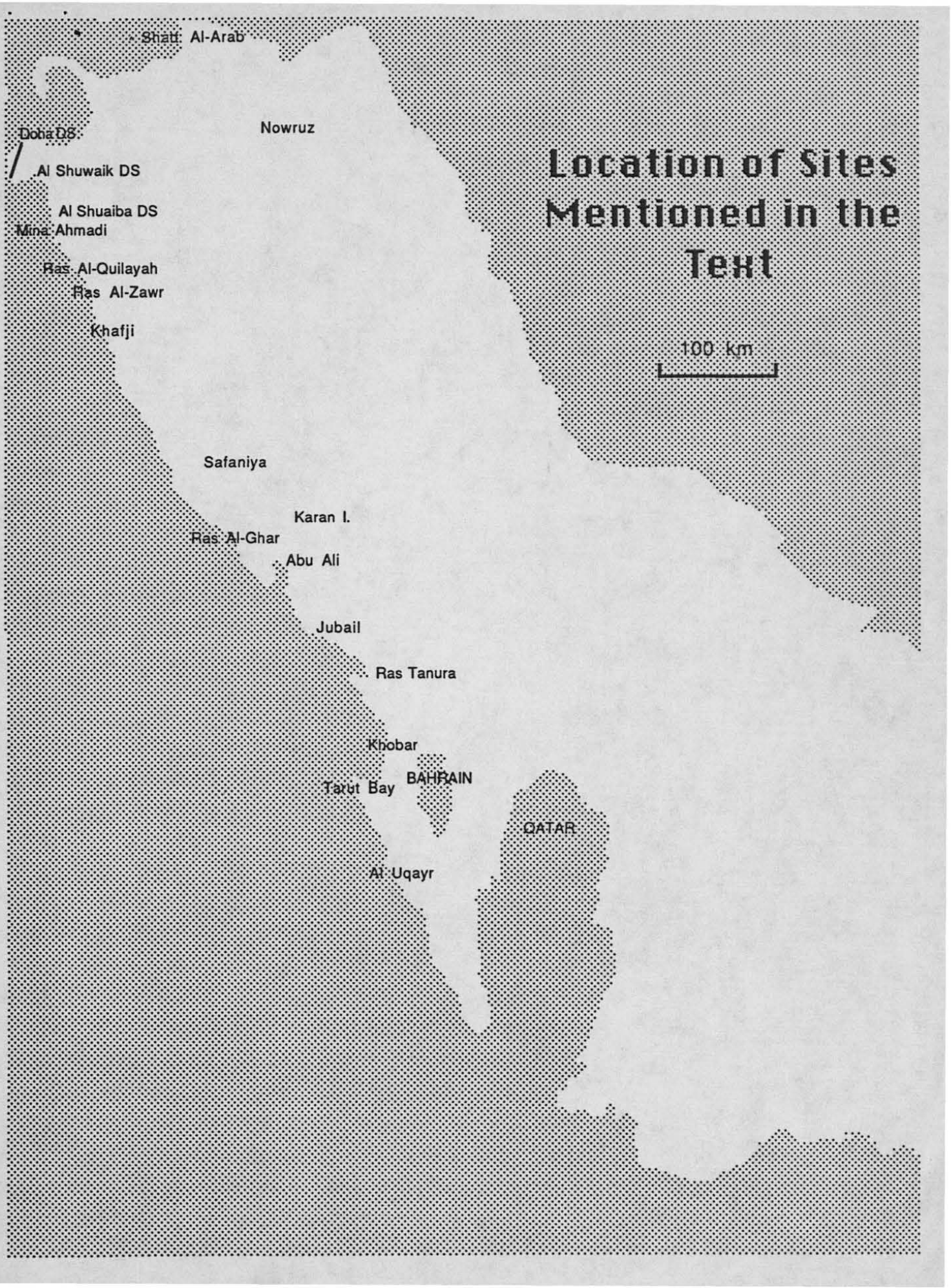
The long term fate of a massive spill in Kuwait waters would be directly related to the ultimate distribution of the highly weathered tar balls that would form from the initial slick. The first effect would be that certain segments of the Kuwait, Saudi Arabian, Iranian, Bahrain and Qatar coastlines would receive oil impacts in the form of scattered tar balls. Highly likely targets would be the Southern Kuwait coastline, Abu Ali Island, northwestern Bahrain and the northern tip of Qatar. In addition, tar mats could be expected to form along tens of miles of shoreline. The oil would be highly weathered and in a relatively non-active, non-toxic form. Mechanical cleanup of this oil would be relatively straightforward.

The second effect would be that sand laden tar balls would sink to the bottom of the Gulf and become part of the bedload and longer term depositional processes. These sand impregnated tarballs would contain highly weathered and relatively non-toxic components. In previous large spills, benthic trawls have shown that small amounts of hydrocarbons are scattered over wide areas of the bottom of the Persian Gulf, and they have not appeared to lead to abnormalities in the benthic communities.

13. Would dispersants or bioremediation be effective countermeasures for a massive spill in this area?

Arabian crude exhibits a extremely strong tendency to form stable water-in-oil emulsions (so-called chocolate mousse) which would greatly decrease the effectiveness of dispersants. The composition of Arabian crude (i.e., high levels of polar compounds, waxes, and asphaltenes) enhance mousse formation. If dispersants were to be effective at all, they would need to be applied very early (hours after spill), and even then their effectiveness would be reduced by the same factors which tend to enhance dispersion, mainly mixing or agitation. After the oil begins to weather due to evaporative losses and photo-oxidation, it will become even less dispersible.

Bioremediation is a process in which nutrients alone or in conjunction with microbes are applied to spilled oil; this technology has been used effectively in the treatment of oil wastes using lagoon and land-farming techniques. Open water application of bioremediation products, however, would not produce quick results, and may, in fact, enhance mousse formation, slowing evaporation and other natural removal processes. Uncontrolled applications of bioremediation agents on stranded oil may have limited utility.


Location of Sites Mentioned in the Text
100 km
Shatt Al-Arab
Nowruz
Doha DS
Al Shuwaik DS
Al Shuaiba DS
Mina Ahmadi
Ras Al-Quilayah
Ras Al-Zawr
Khafji
Safaniya
Karan I.
Ras Al-Ghar
Abu Ali
Jubail
Ras Tanura
Khobar
BAHRAIN
Tarut Bay
QATAR
Al Uqayr

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04. Cable	From Embassy, Riyadh to Secretary of State Re: Saddam's Oil Slick--Saudi Wildlife Commission Role (2 pp.)	01/26/91	(b)(1)	C

Collection:

Record Group: Bush Presidential Records
Office: Domestic Policy Council
Series: Schulteiss, Dean
Subseries: Subject File
WHORM Cat.:
File Location: Iraqi Oil Spill [6]

Document Declassified
(Document Follows)
By [illegible] (NLGB) on 11/9/1999

Date Closed:	1/28/2003	**OA/ID Number:**	CF00553-011
FOIA/SYS Case #:	1998-0099-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:	98-0099-F/1(91)	**MR Case #:**	
AR Disposition:	Released in Full	**MR Disposition:**	
AR Disposition Date:	11/9/1999	**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
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(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
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(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
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(b)(9) Release would disclose geological or geophysical information

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DOE FOR IE - EASTON, GRUNDY, BRODMAN
USIA FOR NEA
E.O. 12356: DECL: OADR
TAGS: EPET, SENV, TSPL, IZ, SA, US
SUBJECT: SADDAM'S SLICK: SAUDI WILDLIFE COMMISSION ROLE
REF: STATE 26063 (NOTAL)
(CONFIDENTIAL - ENTIRE TEXT)
1. THIS IS AN ACTION MESSAGE - SEE PARAGRAPH 5.
2. ON JANUARY 26 ECONOFF DISCUSSED, PER REFTEL, THE EFFECTS OF SADDAM'S OIL SLICK WITH DR. ABDULAZIZ ABUZINADA, PRESIDENT, SAUDI NATIONAL COMMISSION FOR WILDLIFE CONSERVATION AND DEVELOPMENT (NCWCD). NCWCD, THE LEAD SAG AGENCY FOR WILDLIFE PROTECTION, HAS FORMED AN INTERNAL TASK FORCE TO ASSESS AND PUBLICIZE THE EFFECTS OF SADDAM'S OIL SLICK ON ARABIAN GULF WILDLIFE AND NATURAL HABITATS. NCWCD HAS MADE THIS MOVE ON ITS OWN, AND DOES NOT YET HAVE A FORMAL ROLE IN THE SAG INTERAGENCY OIL SLICK GROUP. HOWEVER, THE WILDLIFE COMMISSION IS HEADED BY FOREIGN MINISTER PRINCE SAUD AL-FAISAL, AND WE BELIEVE THAT NCWCD MAY SHORTLY SECURE A SEAT ON THE INTERAGENCY GROUP.

3. ASKED ON JANUARY 26 FOR A PRELIMINARY ASSESSMENT OF ENVIRONMENTAL DAMAGE. ONE STAFFER TOLD ECONOFF THAT THE SLICK COULD SEVERELY DAMAGE SHRIMPING AND FISHING IN THE WESTERN GULF FOR A DECADE AND RESULT IN THE DEATHS OF TENS OF THOUSANDS OF DIVING BIRDS SUCH AS THE CORMORANT AND OTHER MARINE AND LITTORAL LIFE.

4. NCWCD HAS CONTACTED THE EMBASSY REQUESTING TWO KINDS OF SUPPORT FROM USG: A PUBLIC AFFAIRS CHANNEL TO HELP THEM BROADCAST THE DEVASTATION WREAKED BY THE SLICK, AND EXPERTISE AND MANPOWER IN ANIMAL RESCUE AND HABITAT RECOVERY. WE WILL WORK THROUGH USIS WITH THE MINISTRY OF INFORMATION TO MAKE APPROPRIATE PRESS COVERAGE AVAILABLE TO NCWCD IN ORDER TO HELP PUBLICIZE THE MAGNITUDE OF THE ENVIRONMENTAL DISASTER.

5. ACTION REQUEST: WE BELIEVE THAT THE SAG INTERAGENCY WORKING GROUP, PROMPTED BY NCWCD, MAY SOON ASK THAT WILDLIFE RESCUE AND HABITAT RECOVERY EXPERTISE BE ADDED TO THE TEAM OF TECHNICAL OIL SPILL ADVISORS BEING ASSEMBLED TO ASSIST SAUDI ARABIA. WASHINGTON MAY WANT TO ANTICIPATE THIS REQUEST BY PLANNING NOW TO INCLUDE SUCH EXPERTISE ON THE ADVISORY TEAM. IF NOT AVAILABLE IN EPA, NOAA OR COAST GUARD, PERHAPS USG COULD DRAW UPON THE RESOURCES OF INTERIOR'S FISH AND WILDLIFE SERVICE. FREEMAN

BT
#0954

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
05. Report	Coast Guard Report--Persian Gulf Oil Spill (4 pp.)	01/30/91	(b)(1)	S

Collection:

Record Group: Bush Presidential Records
Office: Domestic Policy Council
Series: Schulteiss, Dean
Subseries: Subject File
WHORM Cat.:
File Location: Iraqi Oil Spill [6]

Date Closed:	1/28/2003	**OA/ID Number:**	CF00553-011
FOIA/SYS Case #:	1998-0099-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

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(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

THE WHITE HOUSE

WASHINGTON

January 23, 1991

MEMORANDUM FOR GOVERNOR SUNUNU

FROM: EDE HOLIDAY

SUBJECT: Impact on Oil Fires and Oil Spills in Kuwait and the Persian Gulf Region

Early this evening, we received the attached package from DOE describing Administration analyses of the environmental impacts of Kuwaiti oil fires. The package was developed interagency by DOD, EPA, DOE, DOI, Commerce, and the U.S. Coast Guard. Admiral Watkins' cover memorandum suggests that DOE, DOD, and NOAA conduct a technical briefing on these analyses for the media.

As a result of Sunday night's 60 Minutes segment, DOE has received numerous press inquiries on this issue. DOE is pressing for a quick decision regarding a briefing or public statement.

White House agencies, particularly NSC and OSTP, have not had an opportunity to consider what kind of public response the Administration should offer. NSC staff is recommending that General Scowcroft support a technical briefing, but General Scowcroft has not yet expressed his judgment. In addition to OSTP and NSC, we have distributed the attached package to OMB, CEA, and OPD.

We expect to have their recommendations early tomorrow morning. I will convey their views to you as soon as we hear from them.

The Secretary of Energy
Washington, DC 20585

January 23, 1991

MEMORANDUM FOR THE HONORABLE JOHN H. SUNUNU
CHIEF OF STAFF TO THE PRESIDENT

SUBJECT: IMPACT OF OIL FIRES AND OIL SPILLS IN KUWAIT AND THE PERSIAN GULF REGION

John:

Over the last month there has been considerable intelligence community activity analyzing the potential strategic and environmental impact of Iraqi actions to light fires in oil saturated trenches throughout Kuwait and deliberately dump large amounts of oil in the Persian Gulf. The National Security Council and the Joint Chiefs of Staff were briefed by Department of Energy (DOE) Intelligence Staff in early January on this issue, and they have tasked their own internal resources for analysis on this subject.

We have identified three recently completed analyses of the various impacts of oil fires and oil spills in Kuwait (Attachment 1). While each of these examines the question from a slightly different perspective, their conclusions are essentially in agreement. All agree that there could be significant environmental and strategic impacts associated with these potential actions. However, even the worst case scenario would not lead to the equivalent of the "nuclear winter" catastrophe recently predicted by some commentators.

There has been considerable interest from the Hill, including a specific request by the Senate Committee on Governmental Affairs, in receiving the Sandia study. I have attached a copy of the author's principal conclusions on the report (Attachment 2) as well as a copy of the Sandia report (Attachment 3).

I have also attached "Questions and Answers" prepared by the National Oceanic and Atmospheric Administration (NOAA) for the National Response Team (Attachment 4). This document was reviewed this morning by DOD, DOE, DOI, EPA and the U.S. Coast Guard, and approved by Secretary Mosbacher, according to Tom Calamore, Chief of Staff at the Department of Commerce. This document is intended for use by several agencies in responding to inquiries from the media and the public.

Release of these documents to the appropriate committees of jurisdiction, as well as a technical briefing for the media conducted by DOE, DOD, and NOAA, should be considered given the level of public, media, and congressional interest. The Sandia study is being examined for potential release by the National Security Council and NOAA's "Questions and Answers" has now received clearance through the interagency process this morning.

Although these documents contain sobering information, we must ensure that the correct information is released or only the "Carl Sagan, gloom and doom nay sayers" will be heard.

James D. Watkins
Admiral, U.S. Navy (Retired)

Attachments

cc: The Honorable Brent Scowcroft

ATTACHMENT 1

REPORTS ON IMPACTS OF OIL FIRES AND OIL SPILLS IN KUWAIT

-- Potential Impacts of Iraqi Use of Oil as A Defensive Weapon, prepared by Sandia National Laboratories for DOE. The report is classified CONFIDENTIAL. This report examines oil fire and oil spill consequences in four impacts categories: optical effects, ecological stresses, reservoir damages, and oil-filled trench issues.

-- Environmental Impacts of Damage to Kuwaiti Oil Facilities, prepared by Pacific-Sierra Research Corporation for the Defense Nuclear Agency. This report examines the impact of the smoke associated with the destruction of Kuwait's oil wells and refineries.

-- Kuwait: Serious Oilfire, Gas and Smoke Dangers, prepared by the U.S. Army Foreign Science and Technology Center for the Army Intelligence Agency. This report is classified SECRET. The report examines impacts of oil and gas fires on the operating environment for U.S. and coalition forces.

ATTACHMENT 2

Sandia National Laboratories

Albuquerque, New Mexico 87185

The principal conclusions drawn from analysis of the Potential Impacts of Iraqi use of Oil as a Defense Weapon are highlighted below. These conclusions offer both good news and bad news in that some of the impacts which have been suggested through the media are non-issues while others are potentially very real.

- Major climatic changes on a global scale are unlikely as a result of burning oil in the Kuwaiti fields. The natural processes by which the atmosphere removes airborne particulate would significantly reduce the total mass of smoke injected into the atmosphere. Also, the total mass of carbon dioxide (a greenhouse gas) released as a result of burning oil is projected to be a fraction of a percent of the mass of CO_2 released by natural processes and is, therefore, unlikely to significantly impact the global climate.

- Demolition of well-heads in the Kuwaiti oil fields could result in losses of 2 to 10 million barrels per day, initially. However, projections are that the cumulative loss of Kuwaiti petroleum reserves will be a small fraction (less than 10%) of their total reserve base.

- Airborne pollutants created by burning oil are unlikely to significantly affect major population centers. Reduced visibility, however, will be present for tens of kilometers downwind from the sources.

- The Iraqis could cause an oil spill of 20 million barrels (or more), about 80 times the amount of the Exxon Valdez spill. Oil discharged from storage tanks, tankers, and pipelines would cause major damage to the fragile marine ecology and to the fishing industry in the region. The Arabian Sea, which includes the Gulf, has the highest marine-life productivity area in the world. Also, desalination facilities which provide a major portion of the fresh water to this region could be seriously affected.

ATTACHMENT 3

POTENTIAL IMPACTS OF IRAQI USE OF OIL AS A DEFENSIVE WEAPON

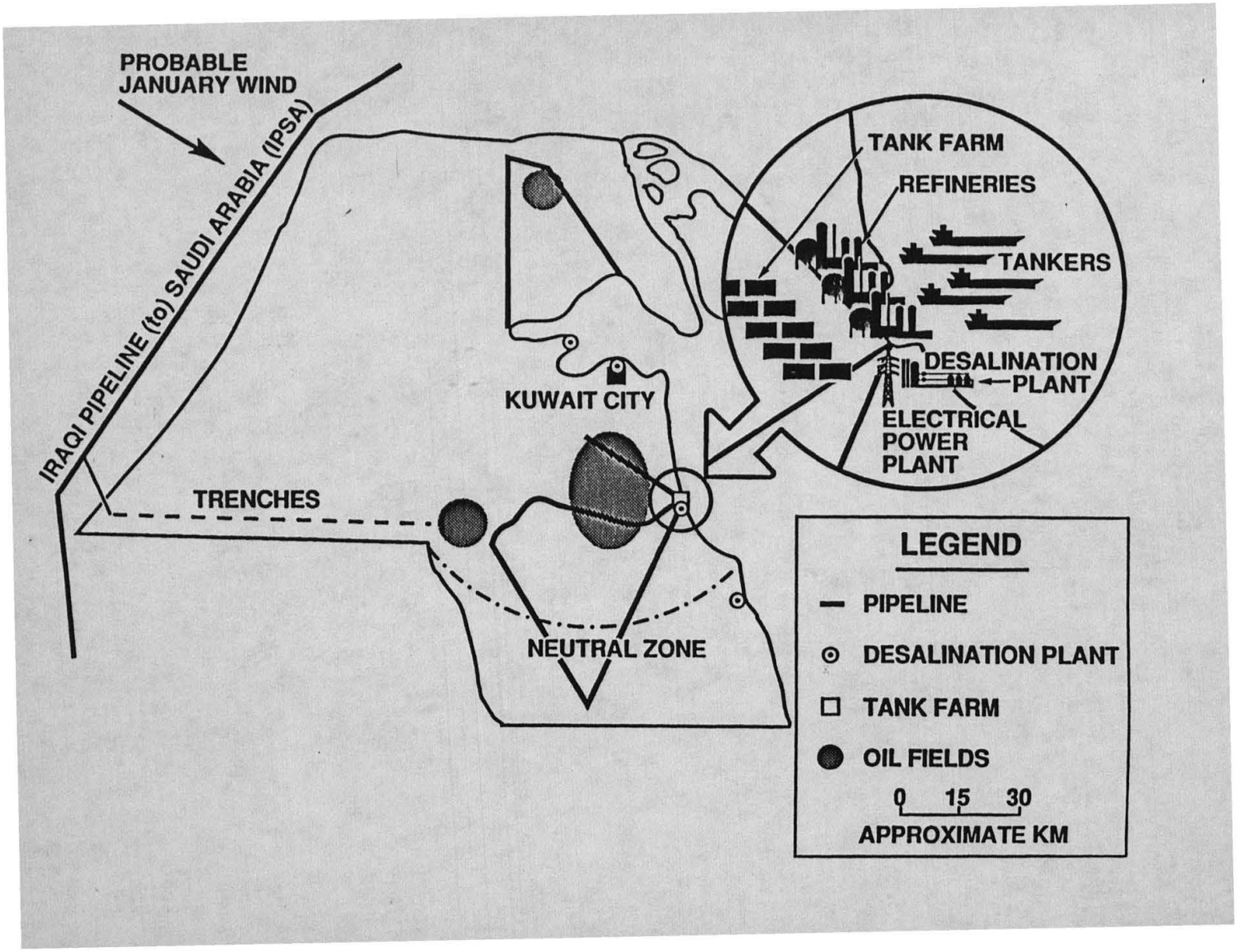
Sandia National Laboratories

JANUARY 9, 1991

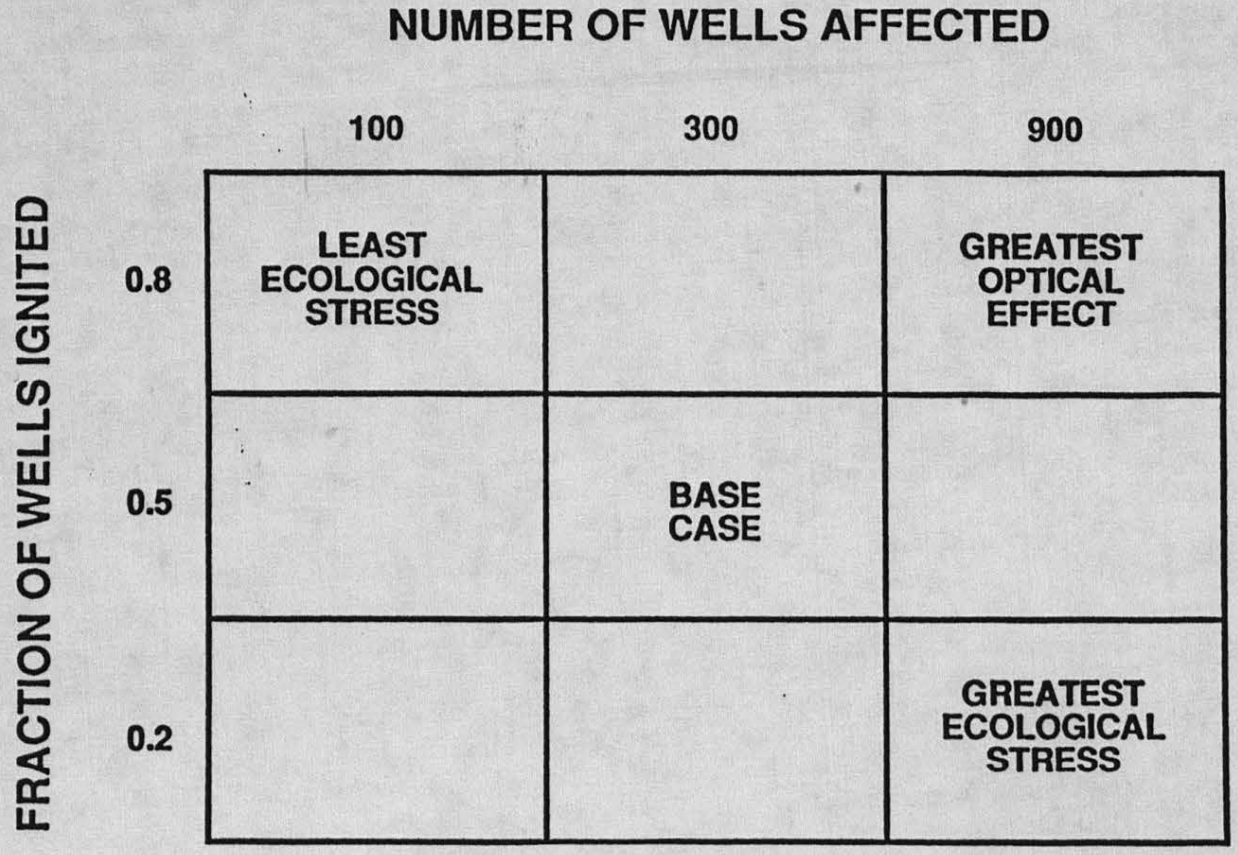
POTENTIAL IMPACTS OF IRAQI USE OF OIL AS A DEFENSIVE WEAPON

Sandia
National
Laboratories

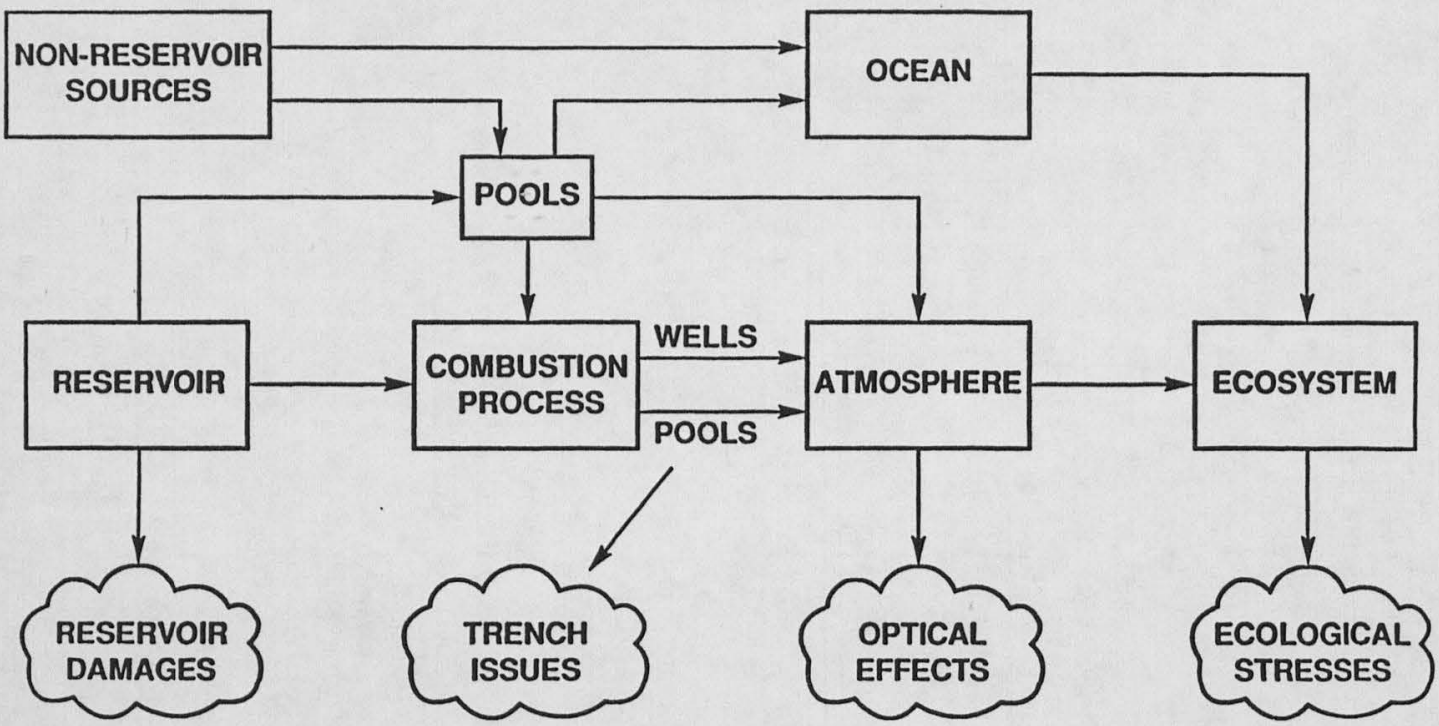
JANUARY 9, 1991


PROBABLE
JANUARY WIND
IRAQI PIPELINE (to) SAUDI ARABIA (IPSA)
TRENCHES
KUWAIT CITY
NEUTRAL ZONE
TANK FARM
REFINERIES
TANKERS
DESALINATION
PLANT
ELECTRICAL
POWER
PLANT
LEGEND
PIPELINE
DESALINATION PLANT
TANK FARM
OIL FIELDS
0 15 30
APPROXIMATE KM

SCENARIO MATRIX



APPROACH


NON-RESERVOIR SOURCES
OCEAN
POOLS
RESERVOIR
COMBUSTION PROCESS
WELLS
POOLS
ATMOSPHERE
ECOSYSTEM
RESERVOIR DAMAGES
TRENCH ISSUES
OPTICAL EFFECTS
ECOLOGICAL STRESSES

IMPACT CATEGORIES

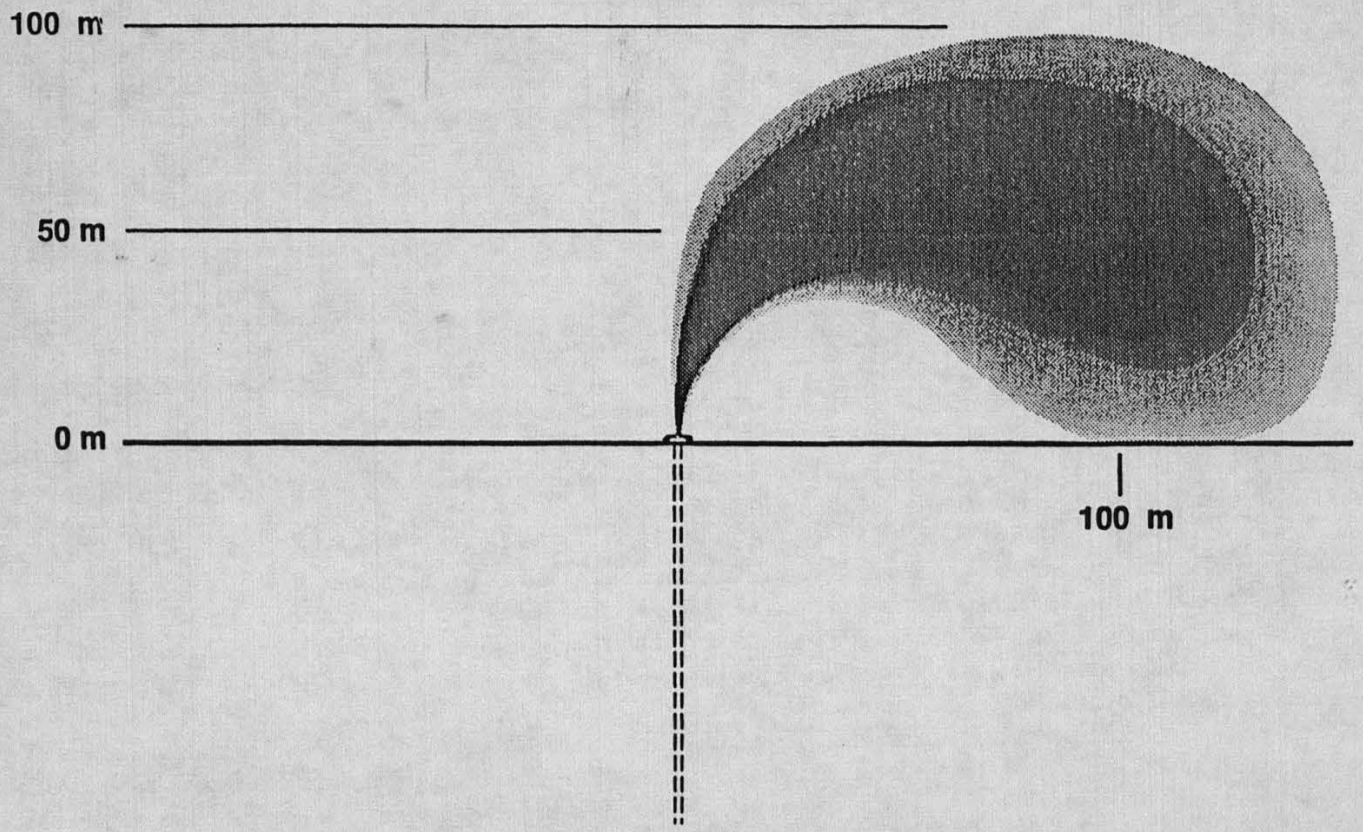
- OPTICAL EFFECTS
- ECOLOGICAL STRESSES
- RESERVOIR DAMAGES
- OIL-FILLED TRENCH ISSUES

OPTICAL EFFECTS

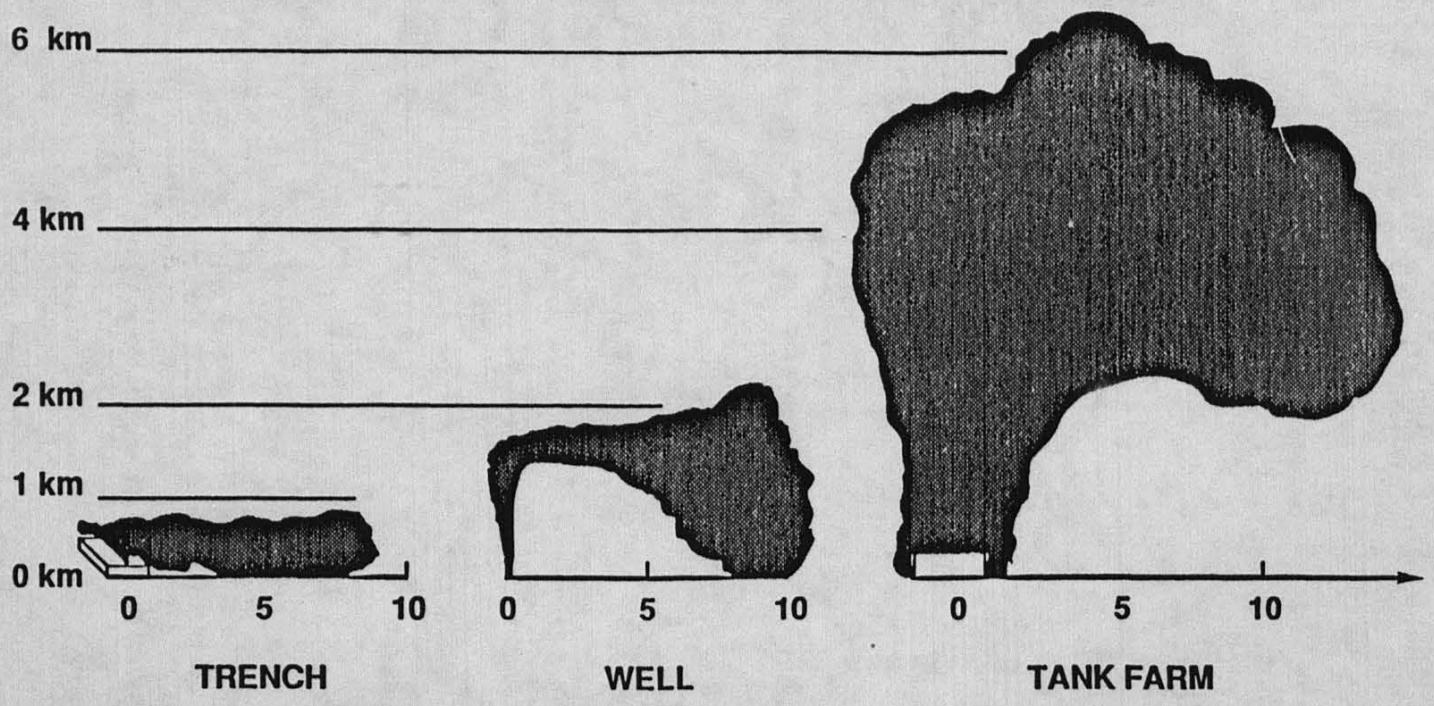
- THE BASE-CASE SCENARIO YIELDS NOONDAY CORRIDORS OF DARKNESS ($\leq\leq$ MOON) TENS OF KILOMETERS WIDE
- THE REGION OF MAXIMUM VISIBILITY DEGRADATION ($\leq$ 1 km VISIBLE RANGE) WILL MOST LIKELY BE 5 KM OR MORE DOWNWIND OF THE COMBUSTION SOURCES AND WILL EXTEND FOR TENS OF KILOMETERS
- PERFORMANCE OF ELECTRO-OPTICAL INSTRUMENTATION USED BY WEAPON SYSTEMS IS EXPECTED TO BE IMPAIRED, MORE SO IN THE VISIBLE AND NEAR INFRARED THAN IN THE MIDDLE AND FAR INFRARED
- HIGH WINDS WOULD DRAMATICALLY REDUCE THE OPTICAL EFFECTS

OIL MIST FROM HIGH-PRESSURE WELL

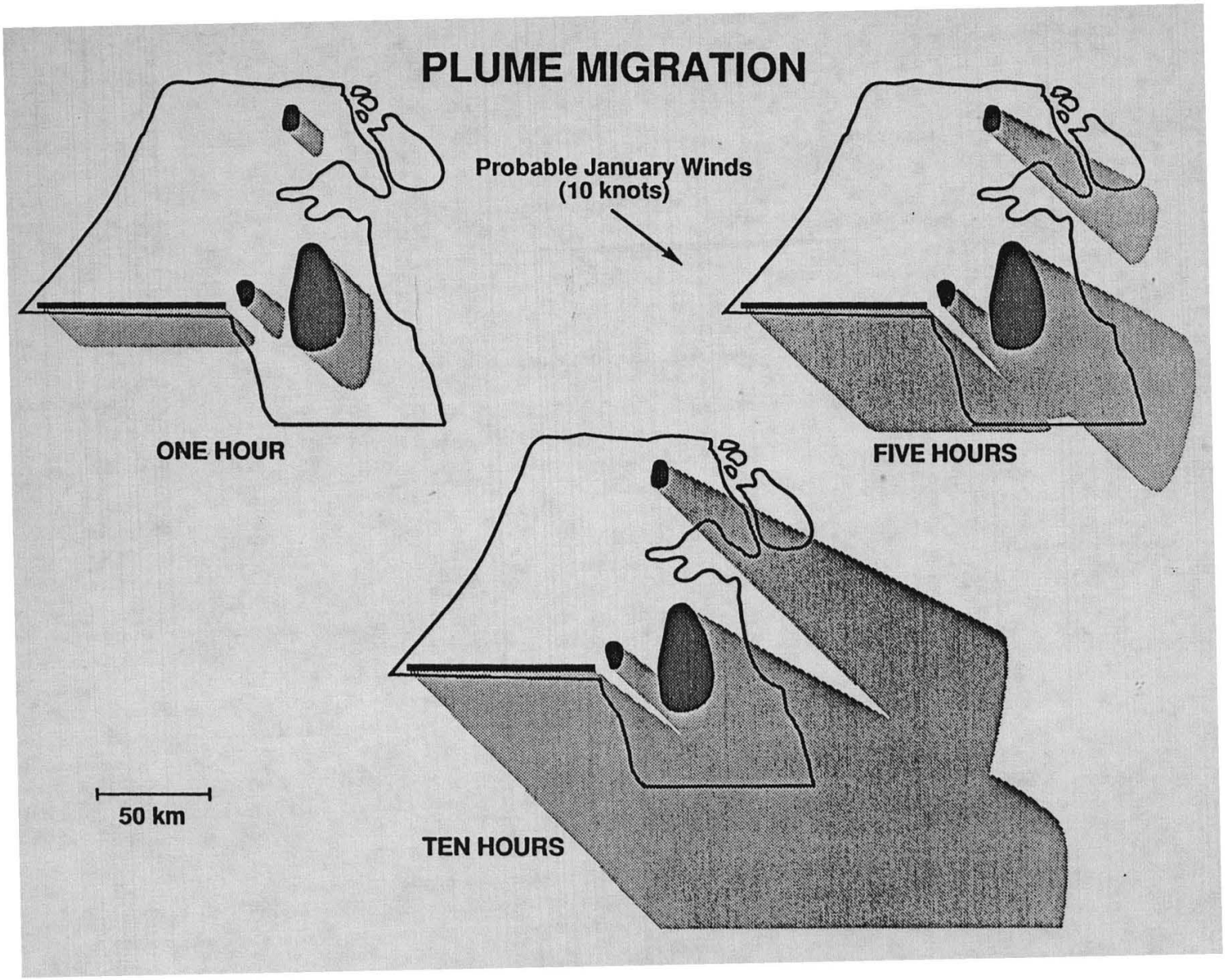
(JUST AFTER WELL HEAD IS BLOWN)



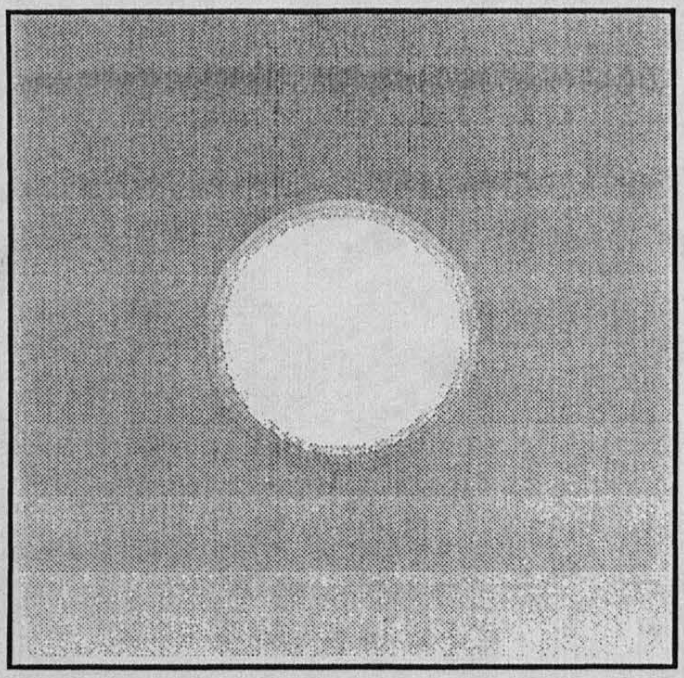
BURNING OIL PLUMES
(30 MINUTES AFTER IGNITION)



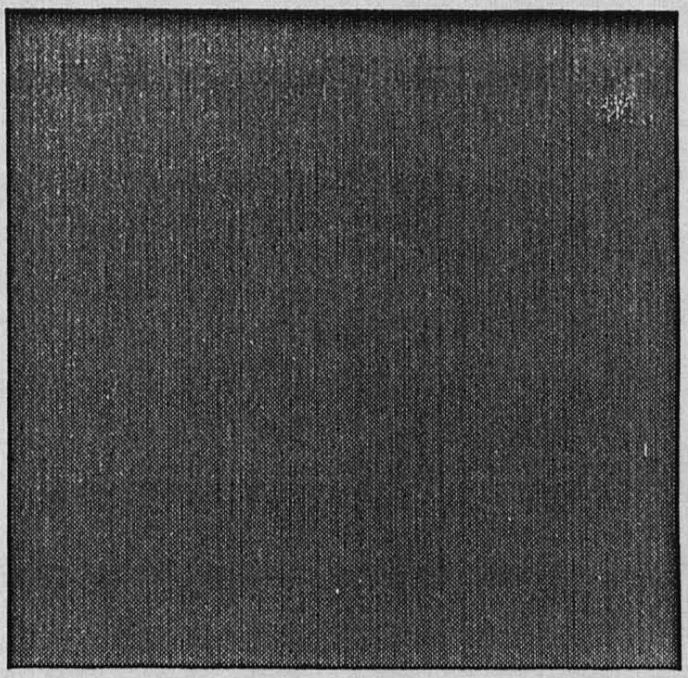
DOWNWIND DRIFT (km)


PLUME MIGRATION
Probable January Winds
(10 knots)
ONE HOUR
FIVE HOURS
TEN HOURS
50 km

NOONTIME ILLUMINATION LEVELS

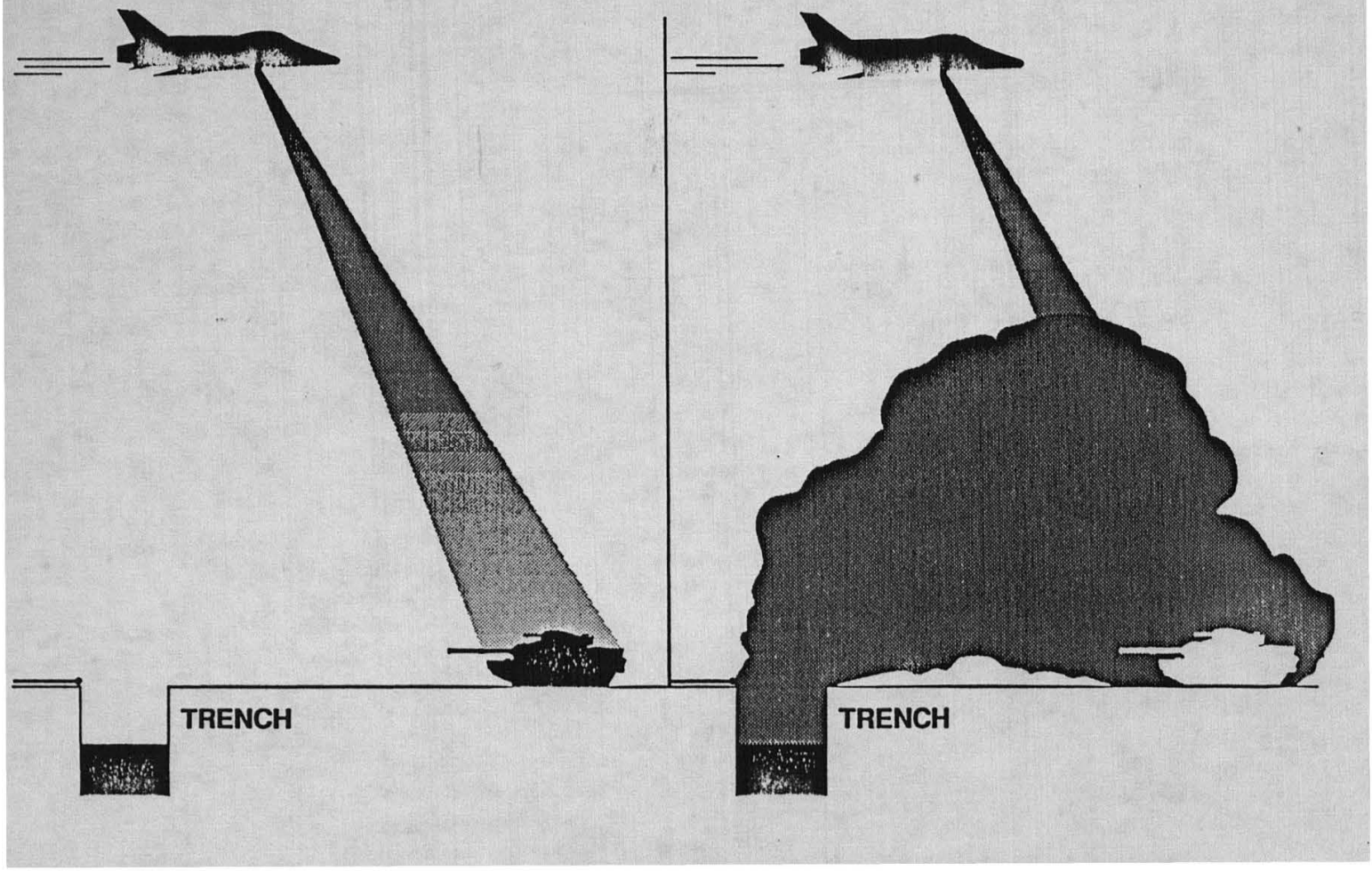


NORMAL



BURNING FIELDS

ELECTRO-OPTICAL EFFECTS



ECOLOGICAL STRESSES

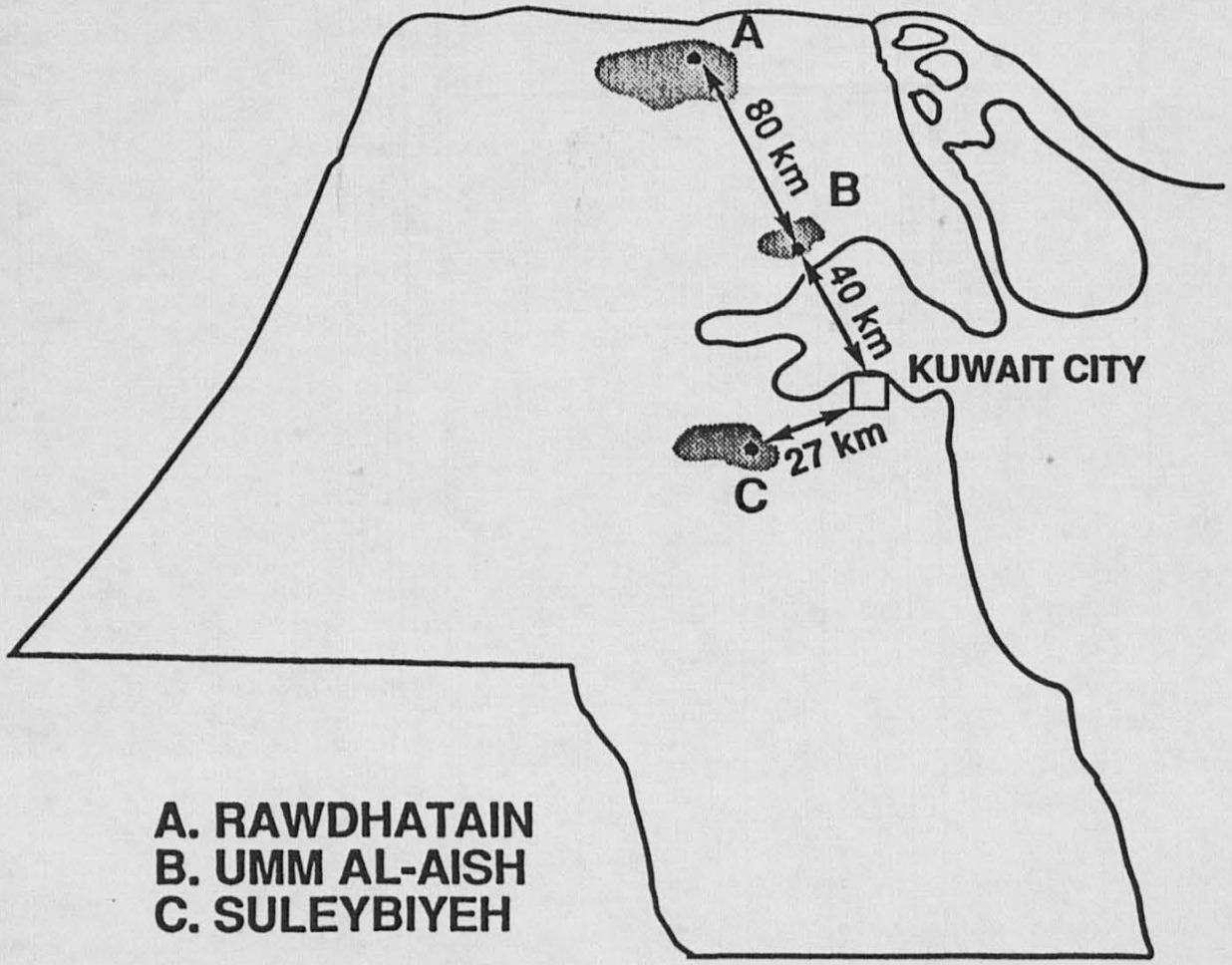
- TOXICOLOGICAL EFFECTS OF AIRBORNE POLLUTANTS — ON BOTH PLANTS AND HUMANS — IS EXPECTED TO BE MINIMAL IN ALL FOUR SCENARIOS

- THE RAWDHATAIN GROUNDWATER FIELD, WHICH SUPPLIES A PORTION OF KUWAIT CITY'S FRESHWATER, IS VULNERABLE TO OIL CONTAMINATION

- A TWENTY MILLION BARREL OIL SPILL (≅ 77 x EXXON VALDEZ) IN THE PERSIAN GULF IS POSSIBLE. THIS SPILL COULD COMPROMISE FRESHWATER SUPPLIES AND ELECTRICAL POWER PROVIDED BY DESALINATION PLANTS TO KUWAIT, SAUDI ARABIA, BAHRAIN AND QATAR. MARINE LIFE WILL SUFFER SEVERE DAMAGE

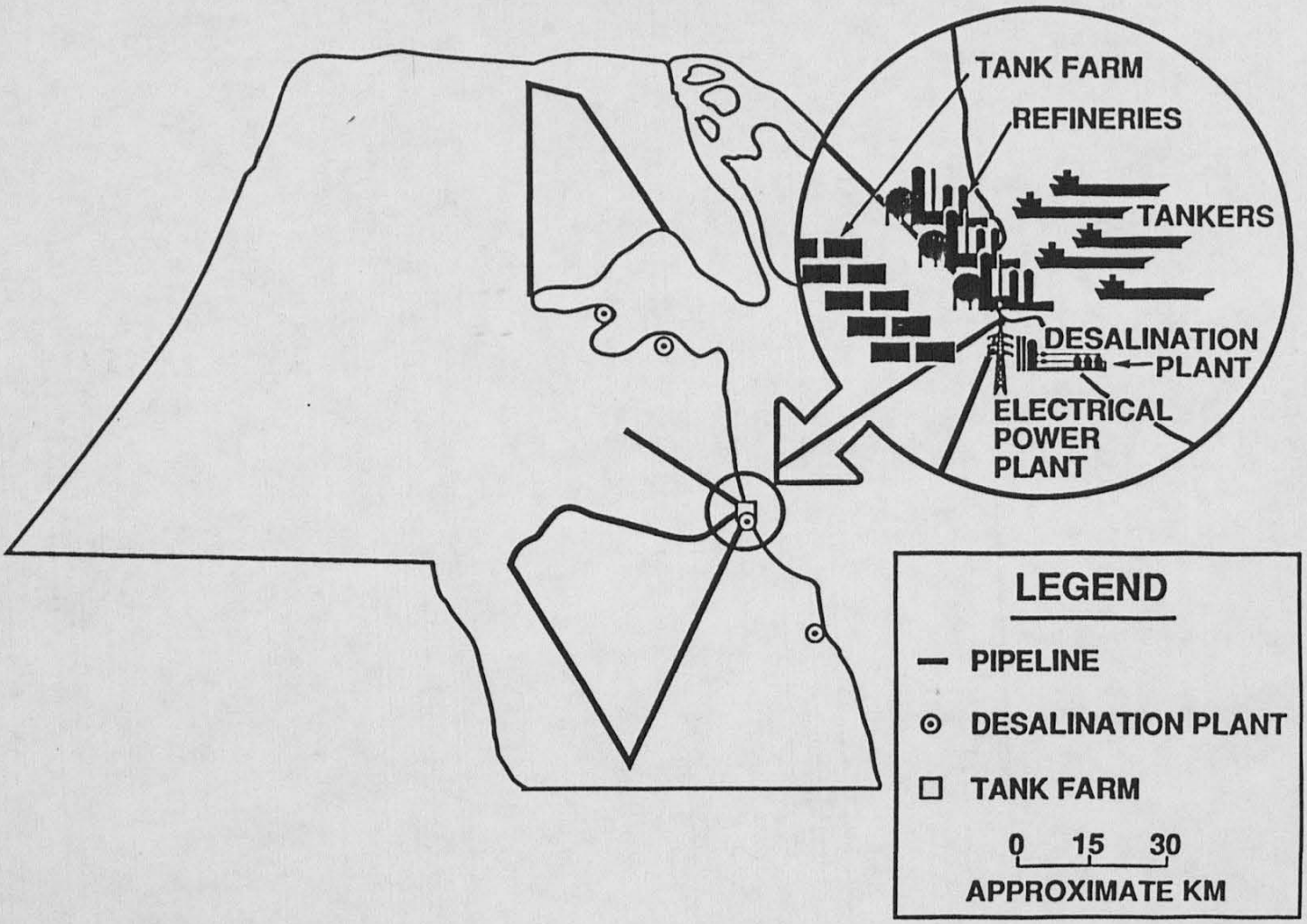
- BURNING AS MUCH AS POSSIBLE OF THE SPILLED OIL WILL REDUCE DAMAGE TO MARINE LIFE AND DESALINATION PLANTS, BUT WILL GENERATE ADDITIONAL SMOKE IN THE GULF

GROUNDWATER FIELDS

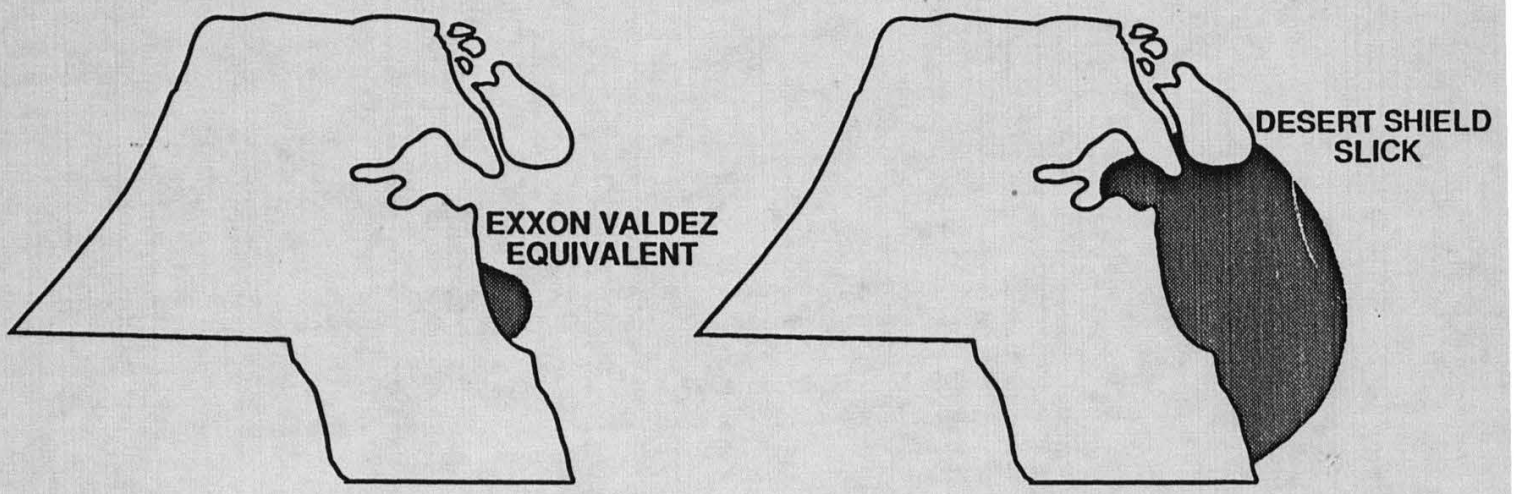


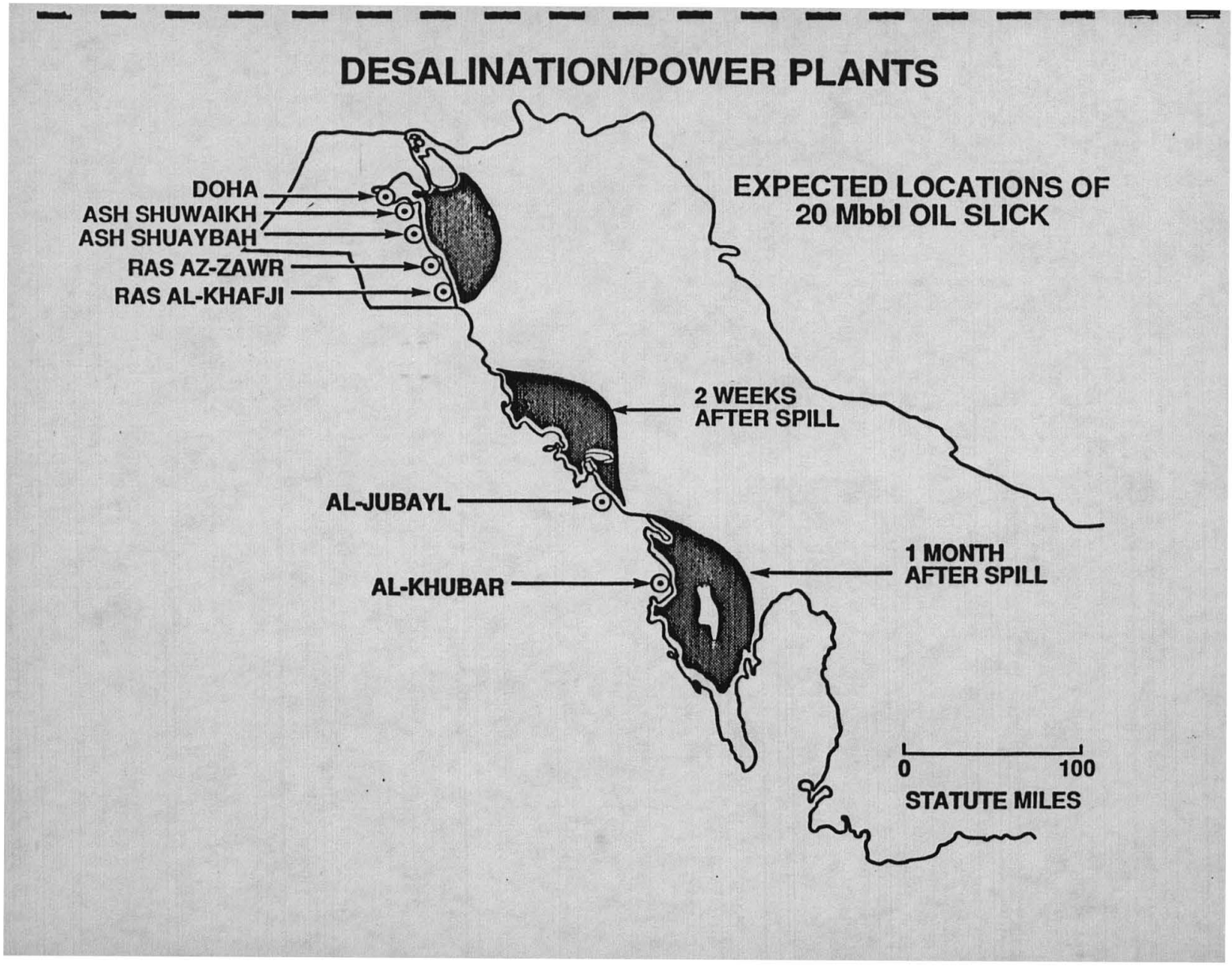
A. RAWDHATAIN
B. UMM AL-AISH
C. SULEYBIYEH

SLICK SOURCE TERMS

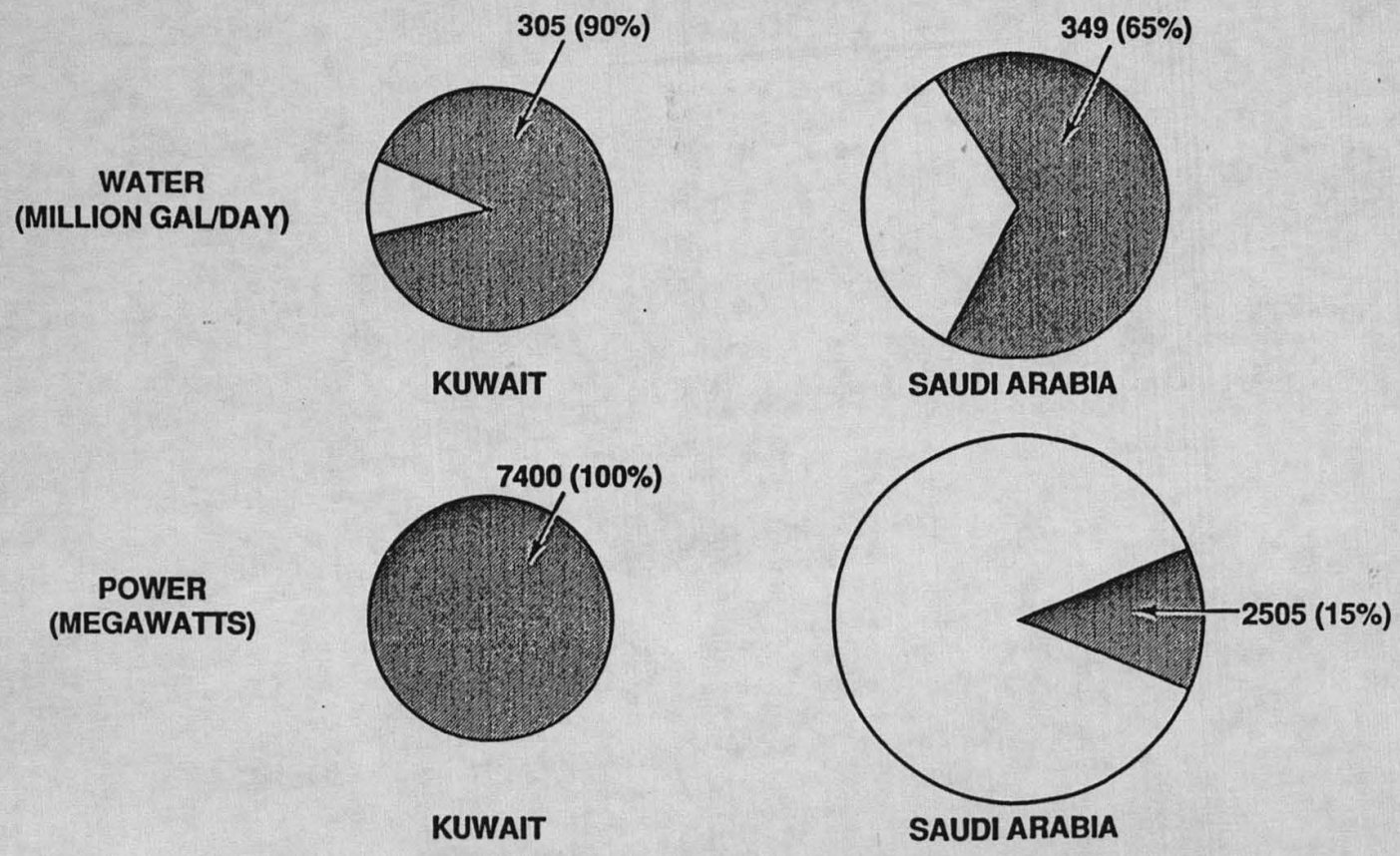


A SLICK COMPARISON

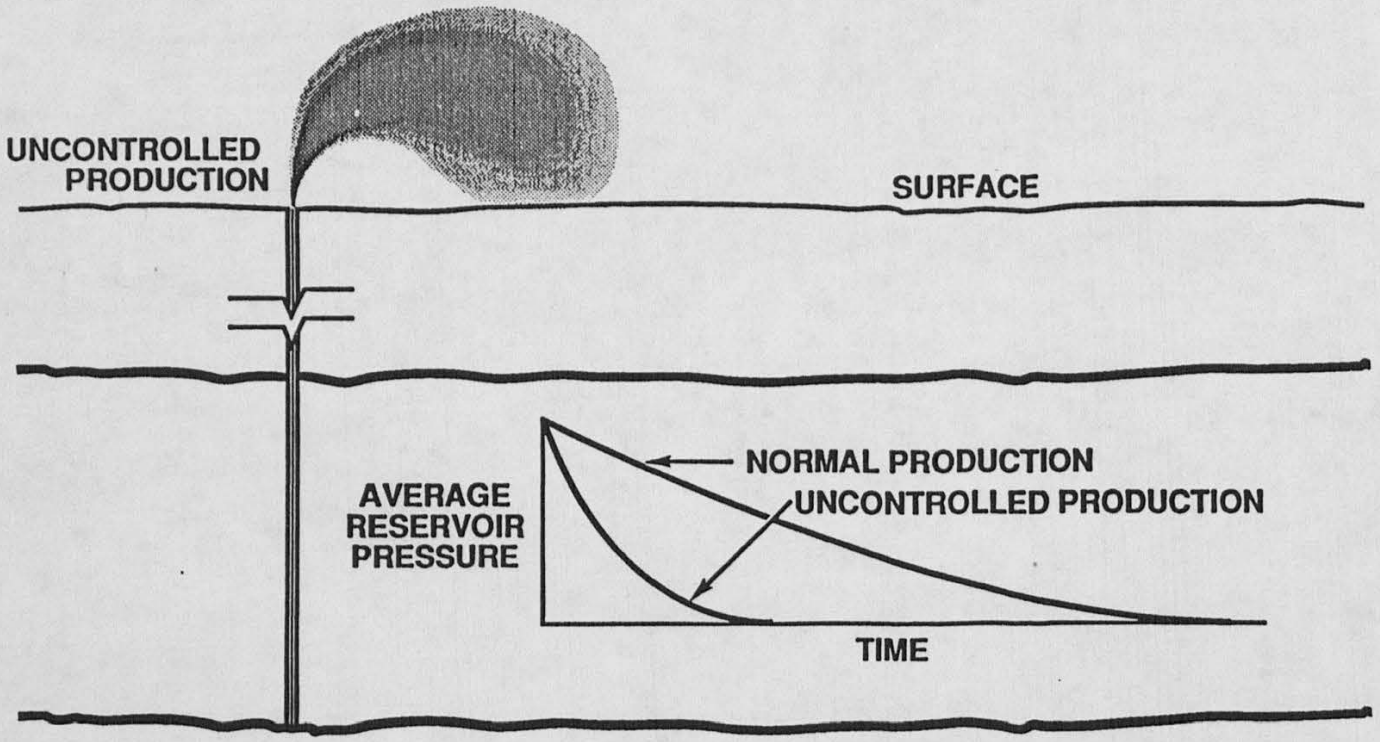



DESALINATION/POWER PLANTS
EXPECTED LOCATIONS OF
20 Mbbl OIL SLICK
DOHA
ASH SHUWAIKH
ASH SHUAYBAH
RAS AZ-ZAWR
RAS AL-KHAFJI
2 WEEKS
AFTER SPILL
AL-JUBAYL
1 MONTH
AFTER SPILL
AL-KHUBAR
0
100
STATUTE MILES

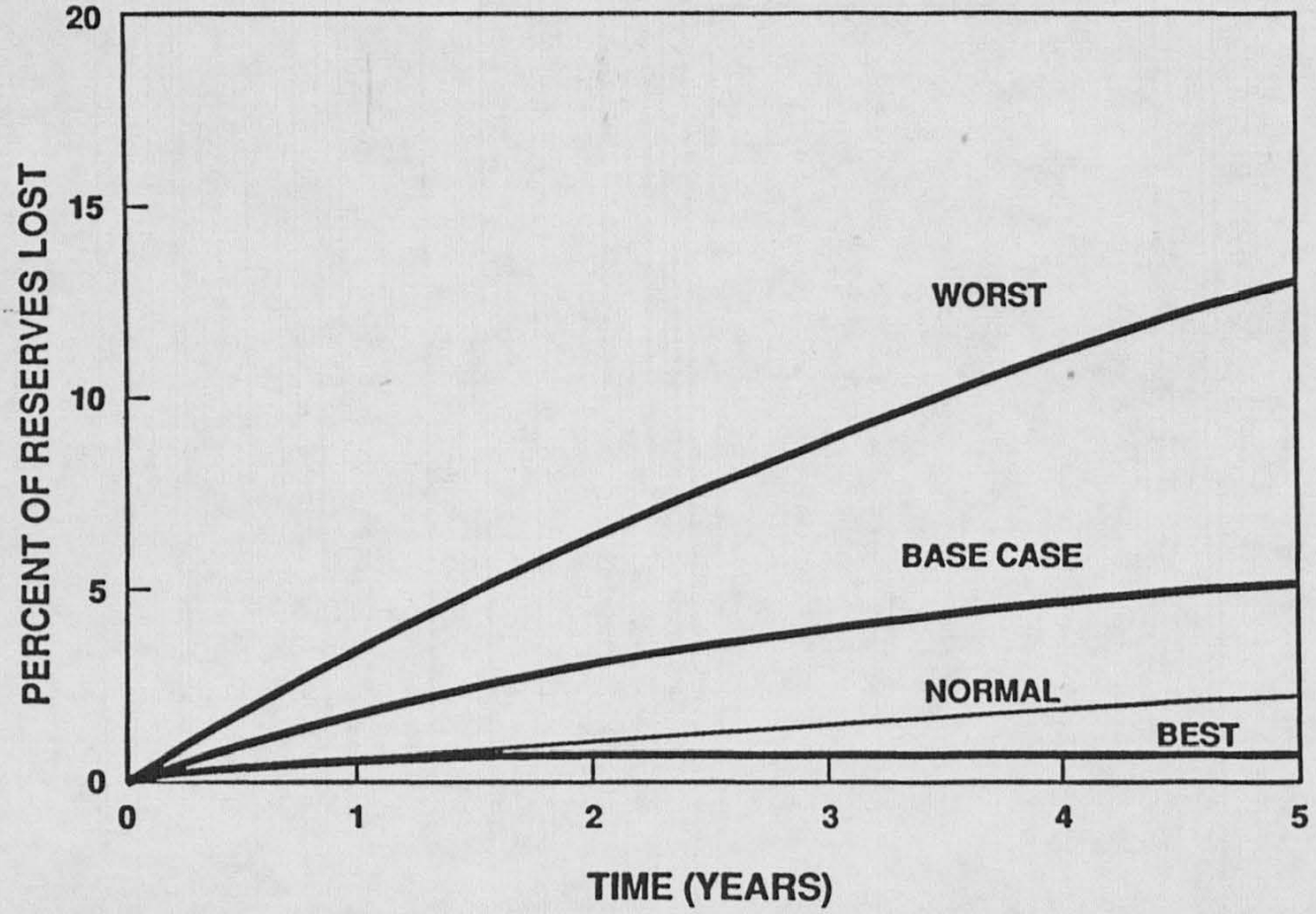
PERCENTAGE OF COUNTRY'S FRESH WATER AND POWER NEEDS GENERATED AT DESALINATION SITES



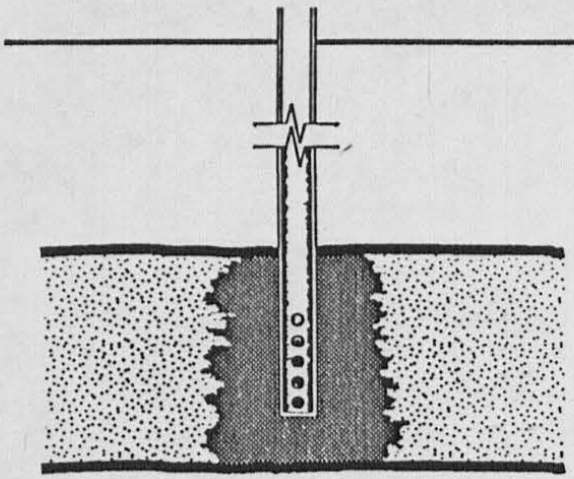
LOSS OF RESERVOIR DRIVE MECHANISM



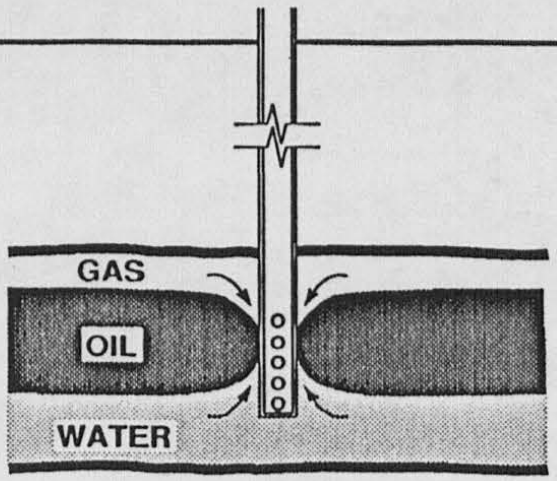
ESTIMATED RESERVE LOSS



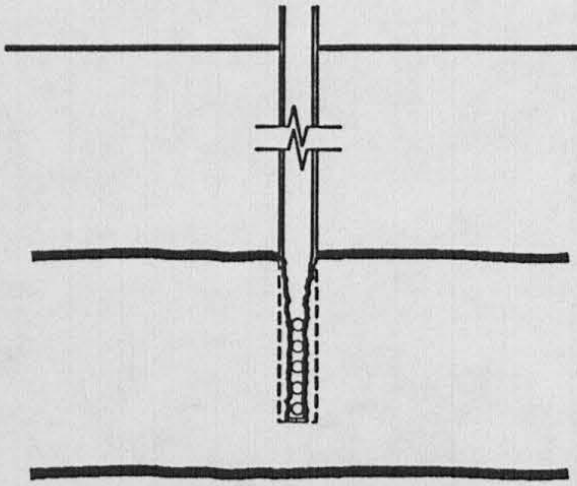
WELL LOSS MECHANISMS



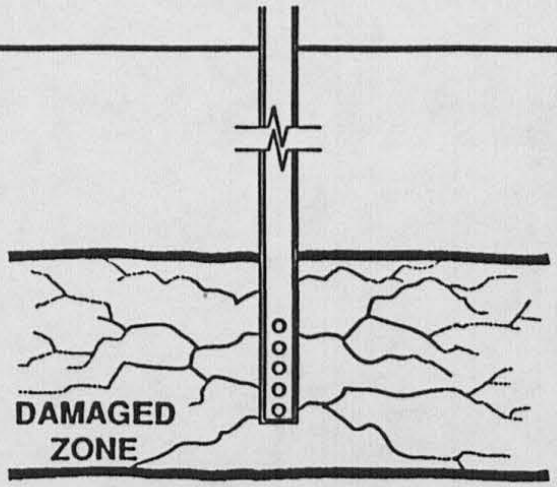
DEPOSITION OF PARAFFINS
AND ASPHALTENES



CONING



CASING COLLAPSE

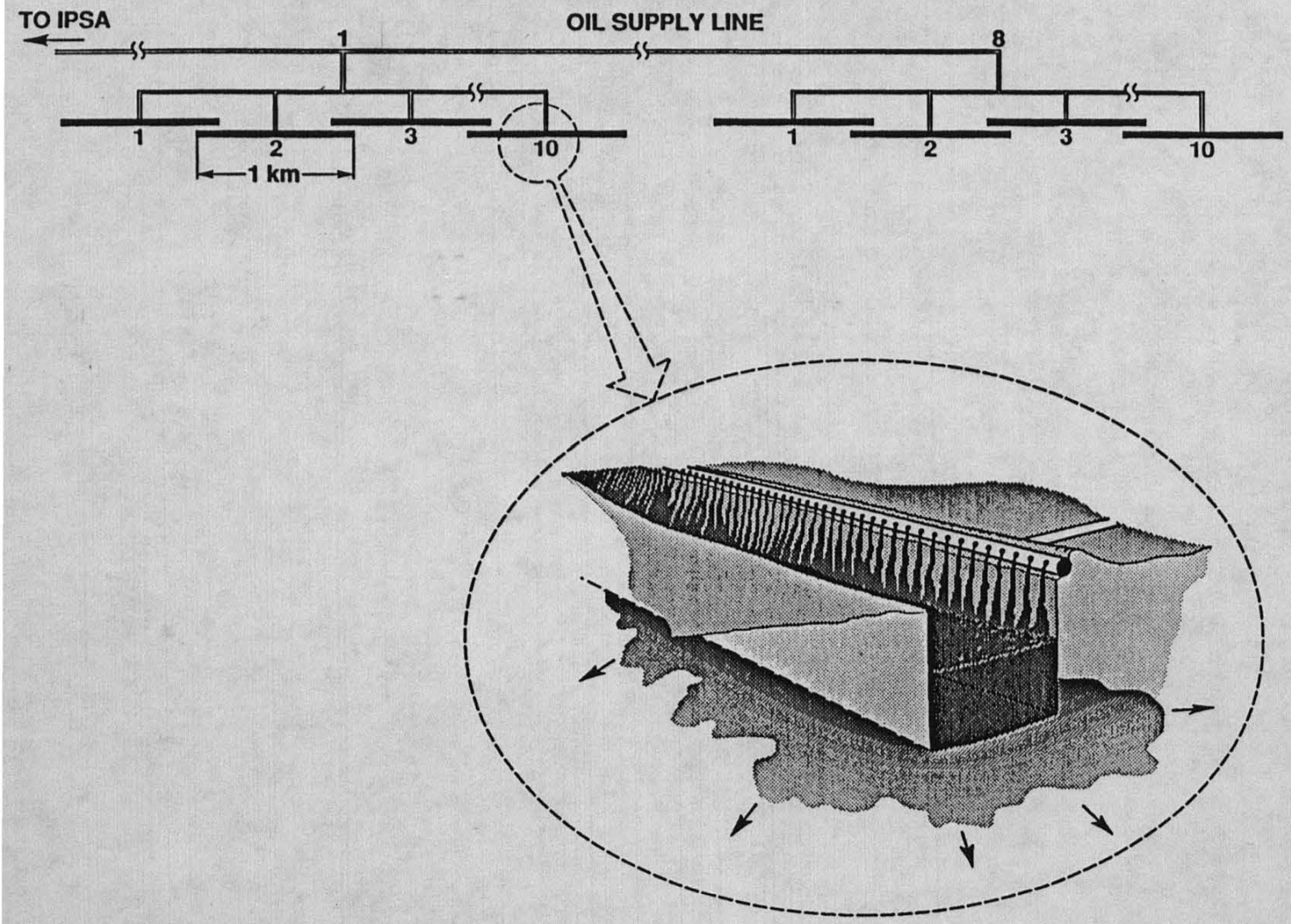


FRACTURE CLOSURE

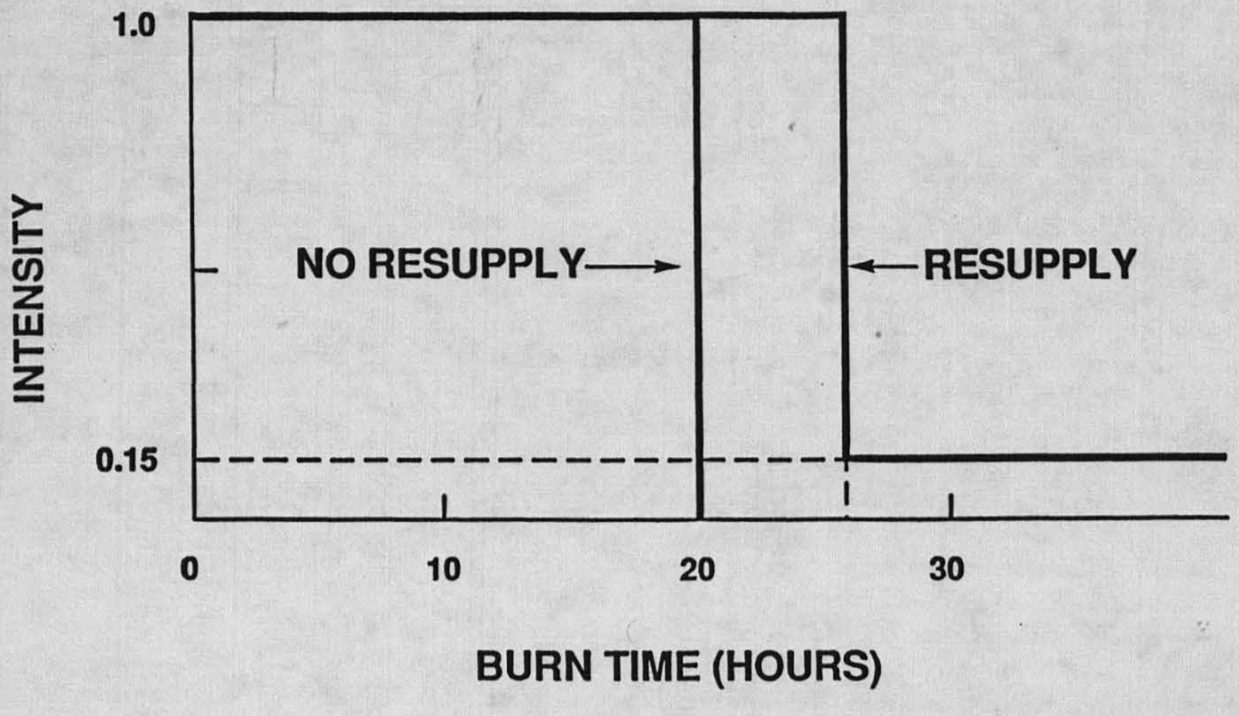
OIL-FILLED TRENCH ISSUES

- TRENCHES CAN BE FILLED IN 145 HOURS (WITHOUT SEEPAGE) THE TRENCHES CANNOT BE FILLED SIMULTANEOUSLY IF CURRENT SEEPAGE RATES (BASED ON SOIL SAMPLES TAKEN 100 MILES FROM TRENCHES) ARE VALID
- THE TRENCHES ARE EXPECTED TO BURN FOR ROUGHLY 18 TO 26 HOURS DEPENDING ON SEEPAGE RATE AND WHETHER OR NOT THEY ARE RESUPPLIED DURING BURNING
- AN EMPTY TRENCH BEING SUPPLIED WITH OIL WILL BURN AT ABOUT 15% OF THE INTENSITY OF A FULL TRENCH

TRENCH ARRAY



INTENSITY OF TRENCH BURN WITH & WITHOUT RESUPPLY



PRINCIPAL UNCERTAINTIES

OPTICAL EFFECTS . . .

- EFFECTS OF SPATIAL (TWO-DIMENSIONAL) SOURCE DISTRIBUTION
- EFFECTS OF WEATHER VARIABILITY
- EFFECTS ON ELECTRO-OPTICAL INSTRUMENTATION SYSTEMS

ECOLOGICAL STRESSES . . .

- RESPONSE AND RECOVERY OF DESALINATION PLANTS
- CONTAMINATION PROCESSES FOR SHALLOW AQUIFERS
- MAGNITUDE OF DAMAGE AND RECOVERY TIME FOR MARINE LIFE

RESERVOIR DAMAGES . . .

- PRESSURE, VOLUME, AND TEMPERATURE DATA ARE REQUIRED TO ACCURATELY PROJECT THE TEMPORAL CHANGES IN OIL AND GAS EFFLUENTS FROM THE WELLS
- NUMBER OF WELLS ACTUALLY AFFECTED AND TIME REQUIRED TO REGAIN CONTROL

TRENCH ISSUES

- ACTUAL SEEPAGE RATES FOR THE TRENCHES
- AVAILABILITY OF OIL FROM OTHER SOURCES

EXECUTIVE SUMMARY

A multidisciplinary team studied the potential atmospheric optical effects, ecological stresses, and reservoir damages that would result from the demolition of wellheads in Kuwaiti oil fields and from the discharge or ignition of oil from nonreservoir sources such as oil storage tank farms, man-made oil-filled trenches, pipelines, and oil tankers. Base-case and worst-case scenarios for the oil fields were considered: in the base-case scenario, 300 wellheads in Kuwait were destroyed and 50% of these were ignited; in the worst-case scenario, all 900 wellheads were destroyed and 80% of these were ignited. The approach in this study was to perform a series of time-phased analyses, each stage of which generated not only immediate results, but also the requisite inputs, or source terms, for the succeeding stage. Hence, reservoir analyses provided source terms for combustion analyses in addition to estimates of reservoir damage; combustion analyses defined combustion products, posed oil-filled trench issues, and provided source terms for atmospheric processes; atmospheric analyses generated potential optical effects and provided source terms for ecological analyses that, in turn, provided estimates of ecological stresses.

Midday light levels are expected to be several orders of magnitude less than on a moonlit night due to extinction of sunlight by soot within a corridor tens of kilometers wide downwind (probably Southeast) from burning trenches. Darkening under plumes from oil fields will vary from modest to more intense than darkening under plumes from the trenches. Maximum degradation of visibility is expected between ground level and 2 km altitude at distances of 5 to 30 km from the sources. Reduced visibility will exist over 100 km from the sources. Major degradation is also expected in the infrared region of the spectrum; consequently, electro-optical instrumentation will be affected. Use of a line source rather than a two-dimensional array of wells is a source of uncertainty (a factor of two or three in optical depth) in these estimates as are meteorological conditions.

In all scenarios, airborne pollutants created by burning oil are not expected to affect major population centers significantly, except possibly a small number of sensitive individuals. Oil spilled over the ground will kill vegetation and is a threat to shallow aquifers and coastal wells. Most vegetation is expected to recover within a year. Oil (77 times the amount of the Exxon Valdez spill) discharged from tankers, pipelines, or on-shore storage tanks into the Gulf will cause major damage to the marine ecology, to the fishing industry, and to desalination facilities in four countries. Detailed quantitative aspects of the damage are uncertain.

Extensive, irremediable losses from reservoir damage are not expected. However, oil losses due to uncontrolled flow could amount to as much as 7 - 10 Mbbl/day in the worst-case scenario and 5 - 6 Mbbl/day in the base-case scenario. The number of wells affected and the time required to regain control of them are uncertain.

Given the Iraqi Pipeline to Saudi Arabia (IPSA) as the only source of oil, anti-tank trenches may not be fillable based on current estimates of oil seepage. If not, IPSA-limited burning is expected to take place in trench feeder lines at about one-sixth the intensity of oil-filled trenches, resulting in still significant concentrations of pollutants and degradation of visibility. Most uncertain are soil properties (seepage rates) from the trenches and the potential for use of added sources of oil (e.g., Southeast Field).

Environmental Implications of a Massive Oil Spill and Fire in the Persian Gulf

Submitted to the National Response Team by the National Oceanic and Atmospheric Administration

January 23, 1991

Background

At the request of the National Response Team, NOAA examined the environmental implications of a massive oil spill and fire resulting from the demolition of oil field wellheads in Kuwait and simultaneous ignition of other non-reservoir sources such as oil storage tank farms, man-made oil-filled trenches, pipelines and oil tankers. This analysis is qualitative in nature, however is based on Department of Energy assumptions as to the possible extent of destruction. The following agencies have been involved in reviewing this document: Department of Defense, Department of Energy, Department of Interior, Environmental Protection Agency, and the U. S. Coast Guard.

1. What would be the characteristics of the plume of smoke from fires in multiple oil wells, tank farms, and from a massive oil spill?

There will obviously be a pall of dense smoke, blocking the sunlight and rising into the atmosphere and extending far downwind. The combustion by-products of burning crude oil are similar in nature to what is found in the exhaust of a poorly functioning truck or automobile. The principal constituents of the plume would be smoke particles, carbon dioxide, and water vapor, all mixed with background air and other gaseous chemicals (mainly unburned hydrocarbons and small quantities of partially oxidized combustion products such as carbon monoxide - the quantities will vary with the size and intensity of the fire). The plume would also contain sulfur dioxide and various forms of nitrogen oxides, which would interact to produce other gaseous compounds.

If the fire is large and/or intense, the supply of air may not be sufficient to permit all the fuel to be completely burned; combustion under this condition would not be complete, and carbon monoxide concentrations would climb. The dangers of exposure to carbon monoxide are well

known. In essence, the larger the fire, the more care should be taken with respect to carbon monoxide poisoning near the source.

If combustion were incomplete, smoke would be denser and smoke particles might carry incompletely combusted hydrocarbons and other constituents that might constitute a health hazard. The health hazards and the characteristics of the smoke vary with the characteristics of the oil, the size of the spill, and to some extent with the prevailing meteorological conditions. In strong winds, there is usually a ready supply of oxygen to support combustion. In light winds, the heat generated causes convection and replacement air is drawn in at all sides, but sometimes not sufficiently rapidly to ensure efficient delivery of oxygen to all parts of the fire. In both cases, it is the surface area of the fire that determines whether there is sufficient oxygen available to ensure more complete combustion.

Considerable relevant information has been generated in studies of oil refinery and storage facility fires. Laboratory and small-scale burning studies over the last 15 years have attempted to characterize combustion by-products under a variety of conditions, however very little information specific to Arabian crude oils has been reported. Most knowledge of the effects of large fires comes from investigations of large forest fires. In practice, the concentration of smoke particles is likely to be the dominant source of health concern, especially for civilian populations.

Ash fallout from the plume might well be cause for concern in the immediate vicinity of the fire. The governing consideration is that the largest particles would fall out first. These could carry unburnt hydrocarbons and other combustion products with them, and some of these compounds could be hazardous to human health as well as to animals living in the area of deposition. The magnitude of this problem would be controlled by factors that cannot be predicted, such as the size and duration of the fire, the completeness of the combustion, and weather conditions at the time. However, serious depositional hazards would no doubt be limited to the immediate region, up to a hundred miles or so from the source.

2. How large an area would be affected by the smoke plume?

Depending on how much oil is burned, the plume should rise initially up to 3000 to 5000 feet. Within the first few miles, the smoke plume would be dense and black. At tens of miles, the plume would be strongly visible. At hundreds of miles, the plume would be diffuse but visible. At thousands of miles it would be barely detectable.

Smoke particles and other combustion by-products from a massive oil fire would enter the mixed layer of the atmosphere (between ground level and 3,000 to 5,000 feet altitude, over arid areas). There is a natural lid on the spread of these constituents to higher altitudes; the height range of 3,000 to 5,000 feet is a rough average that would be modified by both meteorology and geography. Particles in the mixed layer would generally stay there for a few days (perhaps as long as a week, and depending on whether or not it rains) before depositing to the ground, and hence the areas affected would not be very large.

In the daytime, heating by the sun would cause the plume to be mixed fairly rapidly -- the rising plume would drop back to ground level within a few miles. At night, there might well be clear space underneath the plume; immediately downwind areas would not be greatly influenced. Under these conditions, the highest surface concentrations would be observed in the early morning, when the elevated plume is first mixed to the ground.

If the fire were large and energetic enough, or during stormy periods, the plume could rise through the mixed layer into the "free troposphere" (between 5,000 and about 30,000 feet altitude). The plume would then meander for a period of weeks, becoming striated but retaining its visible identity for perhaps a thousand miles or more. At such long ranges, however, the plume would be widely spread and quite diluted.

It does not appear possible for a fire of this kind to generate enough energy to inject particles into the stratosphere (above 30,000 feet) unless aided by severe storms. Storms of sufficient intensity to cause this effect occur near the equator, but not at Middle Eastern latitudes. Other than by intense equatorial storms, stratospheric injection of surface material occurs only with the most vigorous volcanic eruptions (such as those of Mt. Agung, el Chichon, Mt. Redoubt, etc.) and with such events as atmospheric tests of nuclear weapons. Even nuclear explosions are not always energetic enough to penetrate into the stratosphere.

In conclusion, it would be likely that the plume would be confined to the mixed layer and the free troposphere. The plume might be detectable for a thousand miles or more depending on the size and intensity of the fire. Effects on sunsets and sunrises might be evident for several thousand miles. Over the intervening distance, the plume would slowly disperse into the surrounding air, large particles would soon fall out and the plume's visible identity would slowly be lost. The residence time of particles in the free troposphere is such that long-term accumulations beyond one or two weeks

would not be expected. Any problems that might result would tend to be more local and regional in their extent.

3. Would the smoke and particles lead to global warming or produce a "nuclear winter?"

The oil fires would be too small to cause any significant global warming or widespread cooling, such as could be produced in the "nuclear winter" scenario. In general, particles in the air can lead to a cooling of the atmosphere near the surface.

The nuclear winter scenario is based on the injection of particles into the atmosphere from hundreds of wide-spread nuclear explosions and the firestorms they would cause. This scenario requires the stratospheric injection (and consequent long residence time) of particles, and even a massive oil fire would not produce enough energy to achieve this effect. Second, the fire would be limited to areas downwind of the Persian Gulf region, whereas the nuclear winter scenario requires a global blanket of particles formed by many such plumes originating across several continents.

4. Would the release of carbon dioxide affect global warming?

Any release of carbon dioxide would have some influence on the warming of the atmosphere, but the amount released by a massive oil fires would be negligible in comparison to what is normally released as a result of burning of coal and other fuels, forest fires, agricultural fires, etc. Even if an oil field which produced a significant fraction, say 10%, of the world's consumption of petroleum were set afire, it would contribute no more than a few percent to the rate at which carbon dioxide is normally produced, and unlikely to significantly increase or accelerate global warming.

5. Would crop productivity be influenced?

Ash and smoke particles will deposit on crops within a few miles of the fires causing a temporary and minor reduction in photosynthesis. Blocking and scattering of sunlight would also have a minor and temporary effect within the first few miles.

Particles in the plume would clearly affect solar radiation arriving at the surface. Near the origin, large particles would create a regime of extended partial shade. All wavelengths of light would be affected, including those that drive photosynthesis. However, large particles tend to deposit relatively quickly as the plume wanders across the landscape. If the plume always followed the same path, then we would expect there to be a swath of reduced crop productivity beneath the plume. But in practice the plume would meander with the wind and so the effect would be distributed and diluted across a broad region rather than focussed on some specific locale.

The average size of particles in the plume would decrease with increasing distance from the origin. Not only do the larger particles drop out first, but new small particles would be generated by chemical reactions occurring in the plume. After the large particles had mostly dropped out, the remaining small particles would act more as scatterers of light than as blockers. Even though the direct solar beam may be somewhat reduced, experiments have shown that most of the reduction is made up by increased scattered light arriving at the surface. Thus, the total radiation available for photosynthesis would not remain as low as would be expected if the direct solar beam only were considered. The overall consequence is that effects on solar radiation and hence on crop productivity would be largest near the fire, and would diminish rapidly with distance from it. If crops are significantly affected, subsistence farming, herding, and grazing could also be impacted.

6. Would there be effects from other constituents in the smoke?

The oil contains about 2.5% sulfur, which will produce significant concentrations of sulfur dioxide if burned in large quantities. In addition, there would be concentrations of nitrogen oxides that, together with the sulfur dioxide, would cause any rain generated from the same air mass as the plume to be acidified more than normal. There could then be localized deposition comparable to, or perhaps somewhat in excess of that observed downwind of industrialized areas (e.g. in Europe or eastern North America). Another potential effect from the release of nitrogen oxides and unburned hydrocarbons could be the formation of tropospheric smog. This effect would be greatest in summer when ultraviolet light and temperatures are highest.

7. How would a massive oil spill, originating along the coast of Kuwait, move and spread through the Persian Gulf?

Winds in the northern Persian Gulf during the first few months of the year are predominantly from the northwest at average velocities of ten miles per hour. The general circulation along the Kuwait and Saudi Arabian coasts is to the south-southeast with a slight tendency for currents to accelerate along the southern coast. Typical current velocities vary from a few tenths of a knot in the north to just less than a knot in the south. A massive spill originating along the coast of Kuwait would move south along the coast, spreading in a widening band. Shoreline oiling would begin almost immediately in Kuwait and the leading edge of the spill would reach Saudi Arabian coastal waters within a few days to two weeks depending on weather and initial source location. A major spill would be transported along the Kuwait/Saudi Arabian coast for hundreds of miles.

Currents within Kuwait Harbor are dominated by tides, reaching a velocity of about one knot at the entrance with weaker currents further back into the harbor. The net effect of harbor currents would be an oscillatory movement in the floating oil that would slowly flush out of the harbor region over a period of several weeks to a month. Prior to this time, local winds would tend to strand a large fraction of the oil along the Kuwait shoreline. Because of variability in the winds, it is likely that all of the harbor shoreline would be impacted, but with more persistent winds from the northwest, oil would tend to concentrate on the southern edge of the harbor along the Kuwait City waterfront. The northern and western sections of Kuwait Harbor have extensive tidal flats which would probably provide areas where large tar mats (collections of submerged oil and sand) would tend to form under conditions of heavy oiling.

Along the east coast of Kuwait and Saudi Arabia the currents flow generally to the south-southwest parallel to the shore. Oil spilled into Kuwait waters is likely to drift down the coast under the influence of this current system and the prevailing winds. The advance of the oil would depend on weather conditions, however oil would typically move between 5 and 15 miles a day along the coast of Kuwait, speeding up slightly as it moved south along the eastern coast of Saudi Arabia. As the oil moved south, variable winds would tend to distribute it into a coastal swath that widened as it moved. For a large spill, coastal impacts would be expected along a large fraction of the shoreline with particularly heavy deposits associated with headlands (Ra's al Quilay'ah, Ra's al Zawr, Ra's al Khafji, and so on down the coast). Oil would tend to accumulate in coastal embayments (north of Jabail, south of Ra's al Ghar, etc.).

In the vicinity of Ras Tanura the flow separates from the shoreline and moves east past Bahrain and Qatar. Under the combined influence of the winds and currents, oil in this area would tend to move toward the southeast and impact the shorelines of northern Bahrain and Qatar. "Cross Gulf" currents in this area have significant mixing effect and previous spills occurring north of Bahrain have resulted in some oil drifting over to the Iranian coastline when westerly winds were present. Gulf waters around and south of Bahrain have sluggish circulation that would tend to accumulate floating oil for longer periods. It should be noted however, that previous spills have not entered the area south of Bahrain, and in the absence of sustained strong winds from the north, impacts in this area are not likely.

8. How might desalinization plants in the area be affected?

Much of the drinking water in the region is provided by desalinated water. Kuwait, for example, gets over three-fourths of its water supply from this source. A large percentage of the drinking water for Riyadh comes from desalination plants on the Gulf. The same plants also supply the majority of the power needs for the region. In Kuwait during the Nowruz spill, it was estimated that an extended summer interruption of power for air conditioning would lead to a large number of fatalities.

Relatively small amounts of oil can affect desalinization plant operations. During the Nowruz oil spill, the Aziziyah desalinization plant in Saudi Arabia was temporarily closed as a precautionary measure because of oil-fouled sediments near its intake. Due to shallow water, the desalinization intakes in many cases are close to the surface.

In the case of a large spill near Kuwait, the three major desalinization plants, Doha, Al Shuwaik, and Al Shuaiba, would be at risk. The first two are in Kuwait harbor and would be at risk from a localized spill in the area. Al Shuaiba is on the southern Kuwait coast and is more exposed, as is the small Saudi plant at Khafji, although the large spill at Nowruz did not reach them.

By the time the spill were to reach the larger Saudi plants at Jubail and Khobar, or the ones in Bahrain and Qatar, it would have weathered substantially with most of its water soluble components removed. The plants in this region have contingency plans to provide protection of the

intakes from floating oil, and in the case of the plant in Jubail, Abu Ali Island offers a natural barrier to slicks from the north.

9. What natural processes would affect the spill?

Arabian crude oil varies slightly from field to field, but once released into the environment a number of processes would begin to change the oil's characteristics dramatically. The most important of these processes would be evaporation, formation of a water-in-oil emulsion, and sand fall. A much smaller fraction of the oil would dissolve into the water column. In combination, these processes would result in about half of the oil being removed from the water surface over a period of a two to ten days. During this period, the density of oil on the surface would increase from an initial value of 0.87 to about 0.96 g/cm^3.

Larger slicks would tend to disaggregate into small floating patches of oil and tar balls. Along beaches, these patches of oil could accumulate, and in areas of heavier accumulations, the patches would run together, mix with sand, and form tar mats similar in consistency to softened asphalt pavement.

Strong winds in the northern Gulf create sand storms that result in very large sand deposition over coastal waters. These tend to be at an extreme during the "shamal" period in spring, but high suspended particulate concentrations are common throughout the year with typical air quality standards exceeded for a significant fraction of the time. These large sand depositions would settle out on a surface oil slick, increasing the density of the oil such that it would sink. Oil reaching the bottom in this manner would do so in a widely scattered form and, unlike the coastal accumulations, not aggregate into tar mats. During the Nowruz spill, large surface slicks did not appear to exist on the surface beyond about six weeks, being removed by evaporation or sunk by sand deposition. Widely scattered tar balls did continue to float for longer periods and occasionally come ashore in isolated patches.

10. How toxic is Arabian crude oil and how does its toxicity vary over time?

Acute toxicity to marine organisms is primarily a function of the percentage of low molecular weight compounds in the oil. For most Arabian crudes, this fraction generally represents 20-25% by weight of the

total oil. These compounds have a solubility in water, under ideal conditions, of about 22 parts per million (ppm).

This level of dissolved hydrocarbons could be acutely toxic to many marine organisms if it persisted in a localized area for a long enough period of time. In laboratory tests, marine organisms suffered a 50% mortality when exposed to concentrations of between 1.1 and 17 ppm over a 96 hour period.

Dissolved hydrocarbons are, however, generally concentrated near the water's surface and persist only until evaporative processes remove the low molecular weight compounds. The rate of this loss is dependant on many factors but is generally rapid. In most spills, elevated hydrocarbon levels are confined to the top meter of the water and usually do not persist beyond several hours.

11. How sensitive are the biological resources of the Persian Gulf to oil spills?

Although several ecological habitats and fisheries resources are at risk, the effects of a major oil spill in this region are not likely to be profound because these resources have survived and apparently rebounded from a long period of oil spills.

Habitats at risk include coral reefs and sea grass beds; important resources include the dugong (a large marine mammal), sea turtles and shrimp. Critical habitats in the region include sections of the coastline of Iran and United Arab Emirates. However, both of these regions are far enough removed from the coast of Kuwait that the oil reaching these areas would be substantially weathered and much reduced in toxicity. Therefore, concern should be focused on important resources of the Northwestern Gulf.

Coral reefs will likely survive a large oil spill unless use of dispersants becomes intensive and prolonged. There are small platform coral reefs between Abu Ali and and Safaniyah off the Saudi Arabian coastline and reefs north of Bahrain and Qatar. In 1980, a spill from a broken pipeline off Ras Tanura impacted the coast of Bahrain. No long term impacts on the coral reefs could be detected. Recent mesocosm studies concluded that healthy reef corals can tolerate relatively short (1 - 5 day) exposure to both fresh floating and dispersed Arabian crude oil with no observable long term (1 year) effects on growth and colonization. Some coral mortality is likely to result if dispersants were used to control the slick over a long

period. Effects of dispersant use would be less during the warm season and most severe during winter months when a natural cycle of bleaching occurs.

Patchy distributions of sea grass beds and mangroves occur all along the Saudi Arabian coastline, in the channels between Saudi Arabia and Bahrain, and between Bahrain and Qatar. These grassbeds provide important habitats for several species including the commercially harvested penaeid shrimp. Young green turtles feed on these seagrasses. While seagrasses could suffer from an impact of fresh crude oil, they have generally quickly recovered after past spills. In 1970, a 100,000 barrel oil spill occurred in Tarut Bay, an area of around 400 sq. km. Tarut Bay contains mud flats, grassbeds, black mangroves and shrimp spawning areas. The spill extended from shore to shore and left large tarmats on the beaches. Even ten years later, surveys of oil on the beach showed that this area was more contaminated than the average Saudi shoreline. There are, however, still living mangroves and an active local fishing industry in this area.

The Dugong, a large manatee-like marine mammal, lives and feeds along the Gulf coast. It ranges all along the Indian Ocean shoreline. Dugong mate in February and March, in shallow water, with a gestation period of 1 year. They have naked bodies, which implies metabolic heat is controlled by blubber. Thus they may be more like pinnipeds than otters. A more serious threat may be physical damage to unseen animals due to boat operations. During the massive and chronic Nowruz spill in 1983, there was some impact on them, but recent observations have shown a stronger than expected population with 900 animals recorded in one sighting in the Bahrain region.

There may be some risk of damage to recently hatched turtle populations if there is heavy oiling of shorelines during spring on several islands offshore of Saudi Arabia but the risk of significant damage to adults is low. The green turtle occurs in the Gulf throughout the year, feeding in seagrass beds. Green turtles are common in Tarut Bay, and often caught in shrimp trawls. The populations mainly breed on Karan, Jana, Kurayan, and Jurayd Islands, less so on other islands. Karan Island is the breeding area for 80% of the Gulf green turtle population. Mainland breeding success is low. Adult and half-grown green turtles are common in local seagrass pastures, between Safaniya and al'Uqayr, but most green turtles migrate far beyond this coastline. They are very common and harvested in the Southern Gulf to the west coast of Pakistan and India, but may not breed there now. Thus, the breeding populations of the western Gulf may be the source of animals as far east as India.

Juveniles can experience high mortality when they migrate across oiled beaches during their release cycle. During the Norwuz spill, there was some turtle mortality on the islands, but, fortunately, this was small because they tended to make their nesting sites on the southern half of the islands and are therefore somewhat sheltered from oil coming from the north.

Oiling studies indicate that oil irritates the turtle's mucus membranes, a condition which can result in lesions. Since they are vegetarians, they are less likely to biomagnify hydrocarbons or their metabolites.

The Hawksbill turtle is also a Gulf resident and may be an endangered species. It also uses island breeding sites. It is common, but less abundant than the green turtle. It is also smaller and carnivorous, feeding on pelagic animals. It makes shallower nests than the green turtle, and nests mainly April-July.

There are a few species of seabirds that occur only in this area, some of which breed in the winter season, and others that migrate through or feed in the area. There have been incidents of large numbers of oiled seabirds during past spills in the region. Birds have been impacted both by direct oiling and by oil contamination of their food supply. Although information on bird populations in the area is not good, there have been other significant impacts on some species by the local practice of egg collection for food. A massive oil spill could result in significant impacts to local populations of wide-ranging species. Species that reside only in this area may have their total populations severely reduced. The coastline serves as a migratory route for other species which may be impacted by oiling of the coastline.

There have been apparently minor impacts to fisheries of past spills. Shrimp are targets of one of the most important fisheries in the northwestern Gulf. Shrimp grounds occur off northern Saudi Arabia, and are subject to harvest by foreign industrial trawlers. After reaching peak landings in 1967-68 (17,000 tons), landings declined into the mid-1980's (9,000 tons). Regional authorities recommended seasonal closure from February through June but such closures may not have been implemented. Recruitment of shrimp increased in 1982-83, but other information suggests overall recruitment has been declining in the 1980's due to environmental degradation, land reclamation in former nursery areas and reduced rate of flow of Shatt Al-Arab waterway. Juvenile shrimp, which presumably occur in eelgrass and inshore in heavily vegetated areas, are

considerably more susceptible to oil toxicity than adults; stocks may be severely damaged by chronic oiling in these environments.

In 1980, a 100,000 barrel oil spill from a broken pipeline off Ras Tanura impacted the coast of Bahrain. No long term impacts on the shrimp harvest could be detected. During the Nowruz spill in 1983, fishing vessels in the region had nets and catch contaminated by oil, but no significant hydrocarbon residues were detected in the fish population.

Kuwait itself has been spared major oil spills except for a 130,000 barrel spill that occurred at Mina Al-Ahmahdi South Pier in 1982. Dispersants were used and subsequent analysis showed increased hydrocarbon concentration in oysters. Shellfish, however, are not a common staple in the local diet.

12. What would be the long-term fate of a massive oil spill in this region?

The marine environmental effects of a major spill in this region are not likely to be long term or irreversible. The long term effects of the Nowruz oil spill during the Iran-Iraq war, one of the largest oil spills in history, appear to have been minimal. The area has been subject to more or less continuous small spills so that background oil pollution levels are high. A 1983 estimate of yearly oil spillage through normal operations was larger than the total amount spilled in the EXXON VALDEZ accident. Because the water is so shallow, the Gulf is flushed quite rapidly for a body of water of its surface area. The estimated flushing time through the Straits of Hormuz is between two and six years. Therefore, the residence time for any pollutant is much shorter than other comparable water bodies such as, for example, the Red Sea.

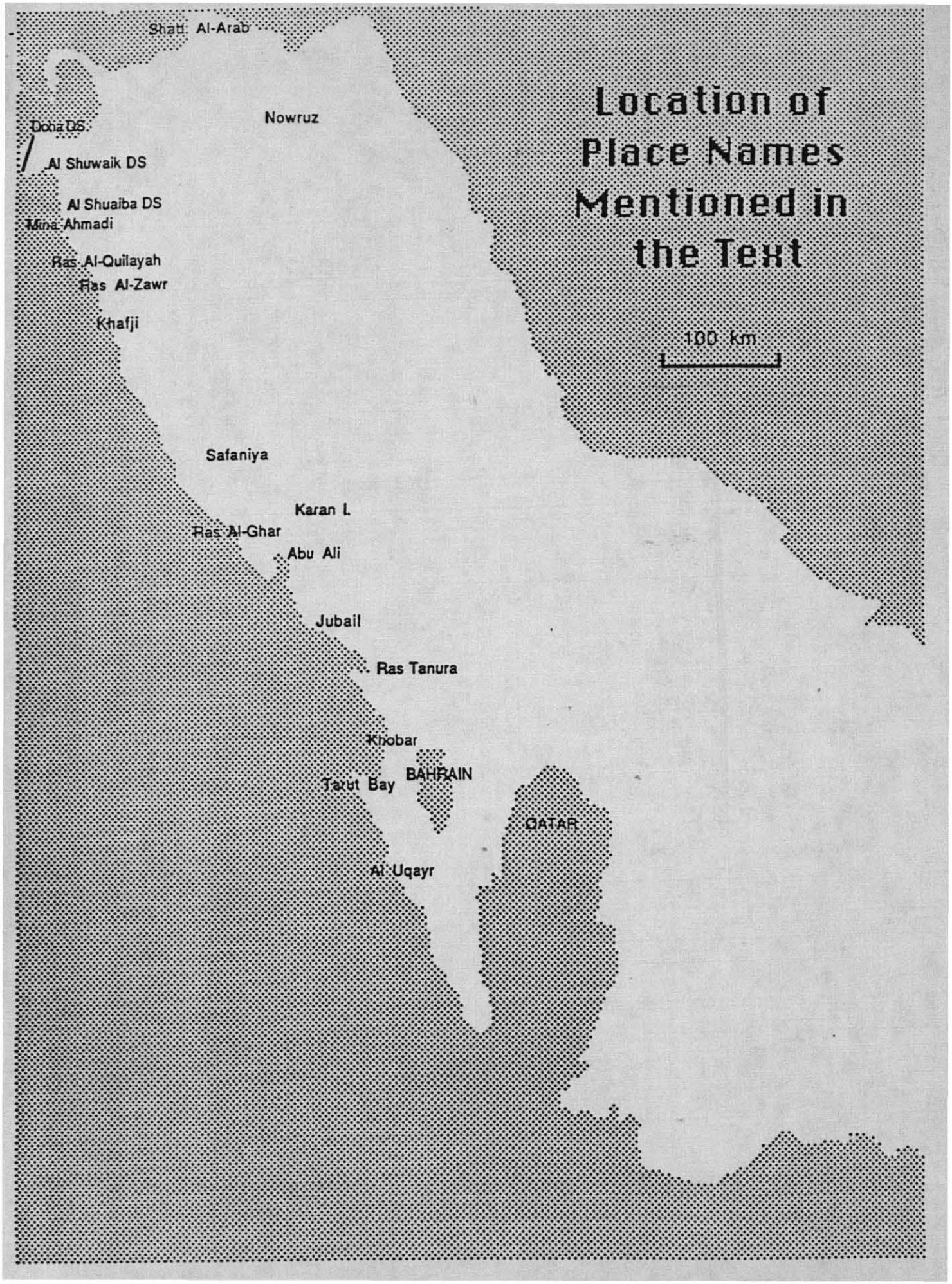
The long term fate of a massive spill in Kuwait waters would be directly related to the ultimate distribution of the highly weathered tar balls that would form from the initial slick. The first effect would be that certain segments of the Kuwait, Saudi Arabian, Iranian, Bahrain and Qatar coastlines would receive oil impacts in the form of scattered tar balls. Highly likely targets would be the Southern Kuwait coastline, Abu Ali Island, northwestern Bahrain and the northern tip of Qatar. In addition, tar mats could be expected to form along tens of miles of shoreline. The oil would be highly weathered and in a relatively non-active, non-toxic form. Mechanical cleanup of this oil would be relatively straightforward.

The second effect would be that sand laden tar balls would sink to the bottom of the Gulf and become part of the bedload and longer term depositional processes. These sand impregnated tarballs would contain highly weathered and relatively non-toxic components. In previous large spills, benthic trawls have shown that small amounts of hydrocarbons are scattered over wide areas of the bottom of the Persian Gulf, and they have not appeared to lead to abnormalities in the benthic communities.

13. Would dispersants or bioremediation be effective countermeasures for a massive spill in this area?

Arabian crude exhibits a extremely strong tendency to form stable water-in-oil emulsions (so-called chocolate mousse) which would greatly decrease the effectiveness of dispersants. The composition of Arabian crude (i.e., high levels of polar compounds, waxes, and asphaltenes) enhance mousse formation. If dispersants were to be effective at all, they would need to be applied very early (hours after spill), and even then their effectiveness would be reduced by the same factors which tend to enhance dispersion, mainly mixing or agitation. After the oil begins to weather due to evaporative losses and photo-oxidation, it will become even less dispersible.

Bioremediation is a process in which nutrients alone or in conjunction with microbes are applied to spilled oil; this technology has been used effectively in the treatment of oil wastes using lagoon and land-farming techniques. Open water application of bioremediation products, however, would not produce quick results, and may, in fact, enhance mousse formation, slowing evaporation and other natural removal processes. Uncontrolled applications of bioremediation agents on stranded oil may have limited utility.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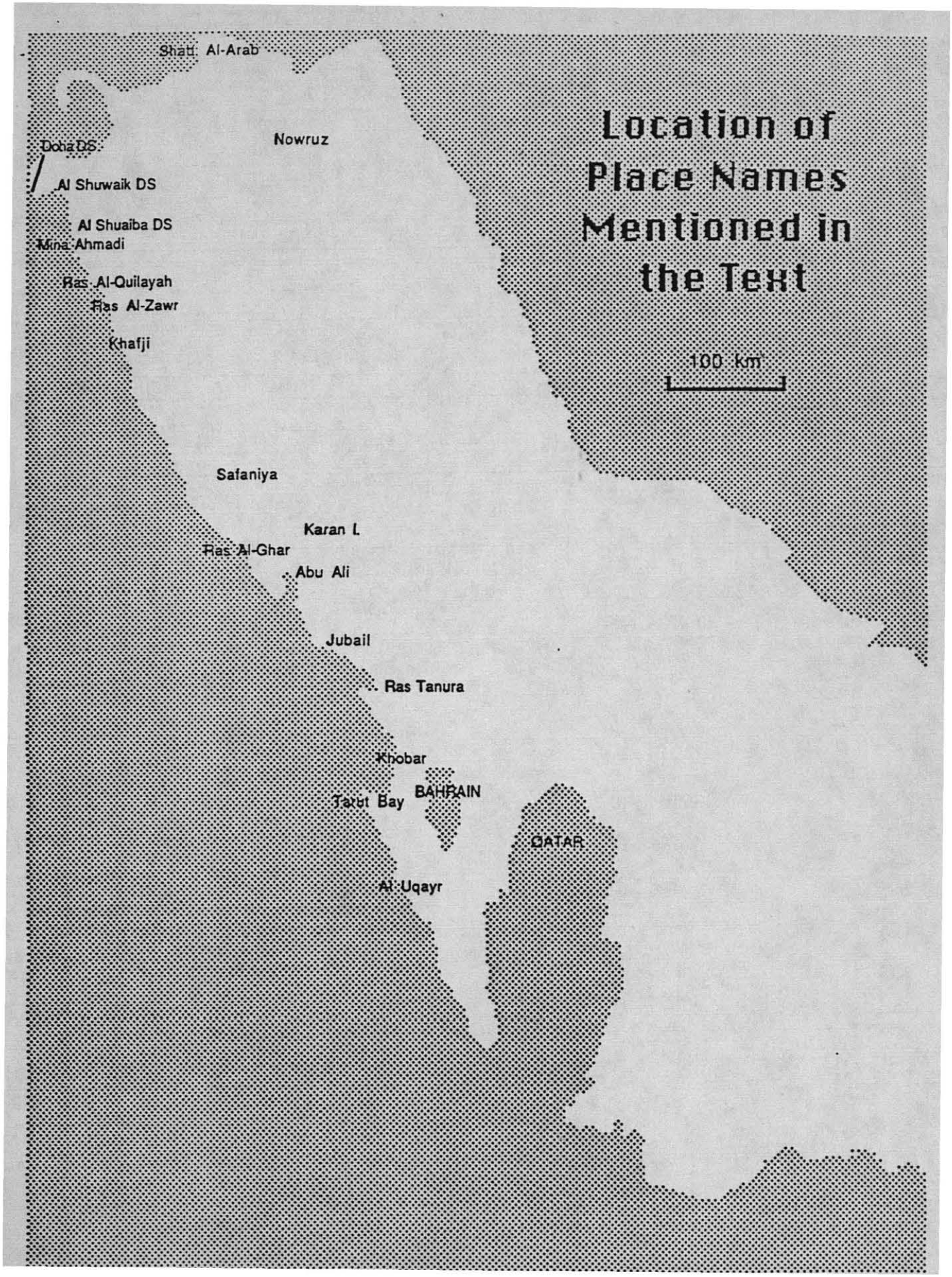
Al Shuwaik DS
Al Shuaiba DS
Mina Ahmadi
Ras Al-Quilayah
Ras Al-Zawr
Khafji
100 km
Safaniya
Karan I.
Ras Al-Ghar
Abu Ali
Jubail
Ras Tanura
Khobar
BAHRAIN
Tarut Bay
QATAR
Al Uqayr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